AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 5, No. 31 WEEKLY. | NEW YORK, AUGUST 5, 1882. | $3.00 per Annum. SINGLE COPIES, 6 CENTS

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Surface Grinder and Surface Plates.

The accompanying engraving of a new surface grinding machine represents a tool designed for producing by an emery wheel flat surfaces upon any small parts of machinery usually finished by filing, or upon hardened dies, punches, &c. With it a workman is enabled to do a much larger amount of work, at a much less cost, than can be done in any other manner.

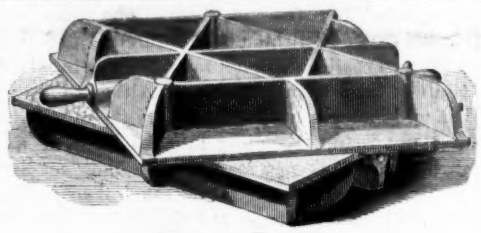
The machine is placed upon a base which forms a receptacle for wheels, wrenches, or any fixtures which may be required about the same, and which makes a firm support for the bed. Upon the bed is a saddle, having a transverse movement of six inches, operated by the small hand-wheel shown at the right. Upon this saddle is a platen which has a longitudinal movement of eighteen inches, through the medium of the larger hand-wheel at the left, the bearing surfaces of both being well protected from dust.

The spindle carrying the emery wheel is supported by a head held between two uprights, which are firmly secured to the bed. It has compensation for wear and protection from dust. It can also be raised or lowered through a distance of five inches, the belt passing over idler pulleys at the back of machine, which can be clamped in any position to give the requisite tension upon the belt.

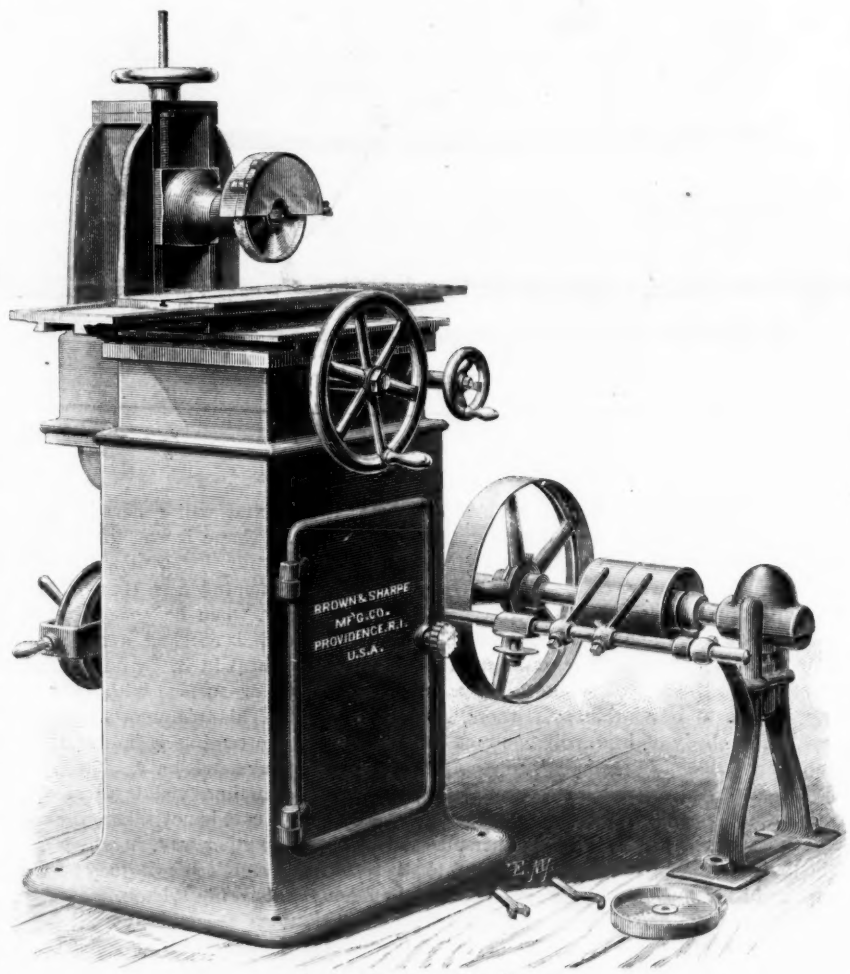
The emery wheel is covered by a guard which can be swung away when necessary to remove the wheel. This machine is simple, easily adjusted, and in the hands of an intelligent workman, is a great aid in the production of accurate work, to which the processes of grinding by emery wheels contribute so largely.

Of the surface plate, it may be said that the requirements of the day are for a nearer approach to perfection in machine tools, and as a consequence a necessity for standards, not only for sizes and lengths, but for plane surfaces. Of the latter, the cut shows a form and style for which not only accuracy is claimed, but also a shape to insure rigidity and a proper selection of iron to make a surface sufficiently hard to retain accuracy during long service. These surface plates are made of several sizes, the largest being five feet long, three feet wide, with a depth of ribs of ten inches; weight a little over one thousand pounds. The scraping of these, of which it was necessary to make three in order to obtain a true plane, occupied nearly six weeks, after being planed as nearly true as could be done with good planers and extreme care.

All sizes are made to rest, when not in use, upon three bearing points, which relieves them of any strain, and all have handles so placed that when lifted by them they can be easily reversed for use. The surface grinding machine, and also the surface plates are made by the Brown & Sharpe Manufacturing Co., Providence, R. I.



SURFACE PLATES.



SURFACE GRINDING MACHINE.

The Maximum Limit of Weight Per Wheel for Locomotives.

At the recent Master Mechanics' Convention, the following question, proposed by Mr. Wilder, was discussed:

MR. HOWARD FRY.—Mr. Wilder is not present, but I believe that I can express his views pretty well, as he and I have discussed the subject quite frequently. In order to raise a discussion there is nothing like exaggerating one's views; and, leaving it for Mr. Wilder to modify what I say in his behalf, I will state that he believes there is a certain weight on the driving wheel which is occasionally reached in practice, which is so detrimental to the tires of the driving wheels that the engines only have to stand still long enough and the tires will be worn out, and that it is an extremely important thing for those designing locomotives to be aware when that point is reached. I think Mr. Wilder is of the opinion that that point has been reached in the practice in America, and that engines now in existence are rapidly wearing out their tires in standing still. This, of course, is a very exaggerated statement of his views, but undoubtedly there is a very important principle underlying it. If there is a point at which tires will be very rapidly deteriorated by the weight placed upon them, and inside of that point they will last much longer, it is very important for us to know it. In other words, the question is, whether when we reach the limit of elasticity in the metal, the tires, and of course the rails, do not wear very much more rapidly than when we keep just inside the limit. If I may illustrate the question in another way, there is an impression that a piece of iron may be stretched, may be strained, a very great many times, almost up to its elastic limit, without doing it serious injury; but that a very few pounds added to the strain and applied to the iron will do it a permanent injury. The question is then: Is there a certain weight we can place upon our tires which will permit them to do good service for a length of time, and is there a very slight addition of weight we can place upon our tires, which will very rapidly wear them out? That is the way I believe in which Mr. Wilder wishes the question to be presented to the meeting.

It has been suggested that it would perhaps make the discussion more rapid if we were to ask for information from the members present, as to what is the heaviest weight which is known to be placed upon any single pair of drivers; and then, if we can ascertain whether the wear of tires subjected to this heavy weight is abnormally rapid; it would, perhaps, lead to conclusions which will be of value to us.

MR. WILDER.—The maximum weight allowed on the driving wheels of locomotives varies much upon different roads. Upon our road the limit which our chief-engineer almost insists upon is 13,000 pounds, 12,000 pounds being the preferable amount. In building our consolidation engines we have put only 11,000 pounds on a single driver, and, if we can be allowed to place, as they are doing now in many instances, as high as 17,000 or 18,000 pounds upon a driver, we can build engines to do the work required with a less number of wheels, and it is a point we should ascertain as soon as possible, because in designing new engines for different classes of work coming up, especially these fast passenger trains, etc., we ought to know what the exact limit is.

THE PRESIDENT.—I have no means at hand to determine the weights carried upon English locomotives per wheel; but I think on some of their engines with single pairs of driving wheels, they must get very much more weight than that indicated by Mr. Wilder. In fact, I think it is not unusual at all to get from eight to nine tons per wheel in English practice. Now, if eight tons, for instance, can be carried on a wheel safely and without detriment to the wheels, tires or track, it is very important that we should know it.

MR. WILDER.—I meant to say, if I did not, that they are already building engines on different roads, notably on the Reading road, and also on the Pennsylvania road, which have eight to eight and a half tons—16,000 or 17,000 pounds—upon a single driver. Some time ago (probably the members of the association remember it) a paper was published by Mr. Chanute, chief engineer of the Erie road, showing that the amount of bearing that the driving wheel had upon the rail did not exceed a tenth of a square inch. That would show that the pressure upon that point, if we had 12,000 pounds on the driving wheel, would be 120,000 pounds. Bessemer steel will take a permanent set at about 150,000 pounds, and with 12,000 pounds on the driving wheel we would then be within 30,000 pounds of the elastic limit. Of course, as the metal gave way, the point of bearing would become larger until it arrived at a point at which it would sustain the load; but, at the same time, it would give the rail a little permanent set (it might be very slight), but by continually increasing that weight we would soon destroy the cohesion of the molecules of the rail and they would peel off. I think you will find that on all these driving wheels where we have got over 12,000 pounds, we have an excessive wear.

MR. SEDGLEY.—I notice that there are several locomotive builders with us, and I will call upon them to give us the heaviest weights that they have applied to their driving wheels. I notice a gentleman from the Rhode Island Locomotive Works. I would ask him if he can give us some information in regard to this matter.

I have always supposed that about 12,000 pounds was the limit for a road on which the rail did not exceed seventy pounds to the yard. Experience has led me to believe that a road must be very well ballasted, and very well tied if that is exceeded, particularly if you are running fast trains. I will ask Mr. Durgin of the Rhode Island Locomotive Works, if he can give us any information in regard to this matter.

MR. DURGIN.—I do not know that I can throw any light upon this matter as regards the wear after the engines go on the road; but, a few months ago I placed an engine on the New York and New Haven road, and it has been in constant use since. I examined it the other day and it showed the best results.

They stated that they would not have a pound taken off under any consideration. Those wheels have eleven tons on each pair, 88,000 pounds on the four wheels.

We have been putting out passenger engines in the last year running from 58,000 to 60,000 and 64,000 pounds. We have one passenger engine running now which is running sixty-two and a half miles in one hour and fifteen minutes, making one stop, that has 62,000 pounds on the drivers, and I cannot see any perceptible wear on that more than on others. Touching Mr. Wilder's remark, that the tire has very little bearing on the surface of the rail when it is first put out, I do not consider that has much to do with it. I think we should give our tires more bearing when they go into service, and not wait for them to wear the rails entirely out. I believe in giving it to them in the first place, and that we will then get better results. It is going to get it sooner or later, and why not give it in the first place? I would have no objection, so far as I am concerned, to going up to 100,000 pounds on four wheels, giving them the proper proportion of bearing. We have to increase our bearings on our journals; why not increase it there also? Of course, there is a limit somewhere. We are improving the quality of tires and rails, and I do not see why we should govern our practice as if we were still using iron tires and iron rails.

Mr. Wilder.—Mr. Durgin says he believes in getting more bearing upon the rail. My idea is that the point of contact of a cylinder (which is what a perfect wheel is) upon a plane (which our rail certainly is), would give nothing but a line, that is, if they just come together; but if there is any more bearing there than that, it must be got by the elasticity of the two metals. You cannot make a cylinder or a circle touch a plane and give anything but a point, a sphere will make a point and a cylinder a line, in length depending on the length of the cylinder, and you cannot get a greater bearing unless you have flat spots on the wheel.

Straightening Crooked Castings.

By Thos. D. West.

"Which way will my casting go?" is a question that the foreman of a foundry is often asked. To answer this question correctly every time would be a very hard task. The foreman may be well versed in the cooling and contraction of castings, but some time a complicated piece will come along that will puzzle him. In some castings the sooner some of the parts are cooled the less liability there is of the casting being crooked, while again there are others that require to be cooled from some certain temperature.

There are two reasons for castings warping. The first is ill-proportioned thickness: the second, the allowing of some parts to cool before others. To these a third reason might be added, viz., the quality of the iron. Bad proportion is, perhaps, the chief cause for warped castings.

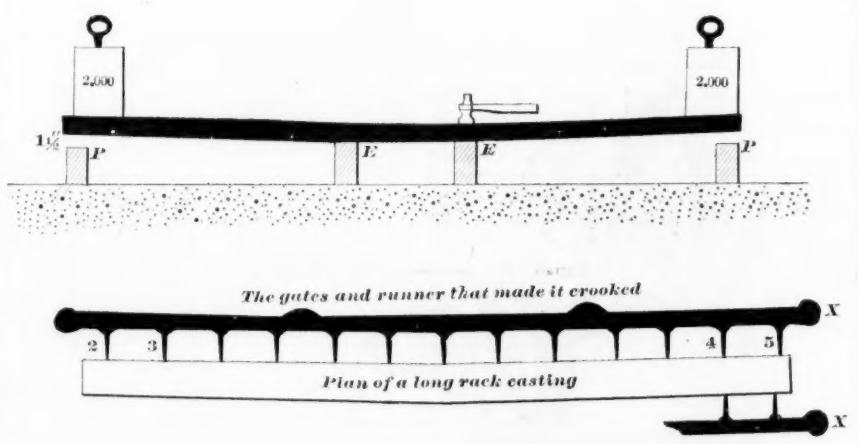
The two sketches illustrate the straightening of a crooked casting, and also how gates and runners often make castings crooked.

Castings for house work give trouble from warping, as they are generally light and long. When the thickness of metal in a column is not equal, the thin side will cool first and draw the thicker side towards it, thereby making the thin side of the column concave and the thick side convex. A variation of $\frac{1}{16}''$ in thickness is often enough to make a column crooked. When care is not taken to have the thickness equal and the core well anchored, crooked columns may be looked for. Cores that are made in half-core boxes, and then pasted together, should always be calipered before setting the bottom chaplets, to see if they are round. Should the core be found to be flat or out of round, the difference should be divided between the top and bottom chaplets.

Moulders will sometimes set a flat core by measuring the prints, and allowing for the variation there, but making no other allowance; and when the cope is set on there will be, perhaps, more thickness of iron on the cope than on the bottom side. If questioned about this by the foreman, they will answer that the core-maker should have made his core round instead of flat. This is all true enough; but, as it is a well-known fact that very few cores are pasted together so as to be exactly round, like a core that is swept up with loam or green sand, the moulder should always caliper them and then the pattern, and set the chaplets accordingly.

There are also many house castings, such as lintels and ornamental work, that are troublesome from having flanges and ribs, for the purpose of strengthening them, and saving iron in the main casting. The flanges or ribs are usually either thinner or thicker than the main casting. It can only be told how a flange or rib will draw a casting in the case of a special pattern; that is, no general rule can be given. The same shaped flange or rib attached to different proportioned castings will not make the castings all draw in the same direction. Although it is mainly flanges and ribs that are the cause of many castings bending into all kind of shapes, we must not lose sight of the fact that the main casting is just as much responsible. Either (the flanges and ribs or the main casting) could generally be cast separately and come straight. When the main casting is the thickest, then we must give our attention to the cooling of that, but when it is the reverse, the flanges or ribs will require especial attention in the cooling.

About all that can be said as regards the cooling of ill-proportioned castings to keep



The gates and runner that made it crooked

Plan of a long rack casting

them straight, is: *cool the thick part and keep the thin part hot.* Try to keep all parts of the same temperature so that their contraction will be equal. There are castings that it is almost impossible to cool so as to keep straight on account of their ill-proportions, and should we by good management do so, we run the risk of having them crack sooner or later, as there is sure to be a strain somewhere, because a thin body of iron will contract in cooling more than a thick body.

With castings in which a strong artificial cooling treatment has to be resorted to, to make them come straight, it is best when possible to have the pattern made crooked to compensate for the warping when cooling. This is very often done in the case of castings that always warp one way. But there are castings in which this would be impossible, because they twist into all kind of shapes, one day being one way and the next day some other shape, and so on. About the best thing that can be done with such castings is to make them of iron, of the least possible contraction. If iron could be had that had no shrinkage qualities, we would not be troubled much with crooked castings.

Weighting down the ends or the middle of long, heavy or light castings, is very often done to keep them straight. Sometimes the weights are sufficient to hold the casting straight without having to resort to any cooling process, and again it is necessary to weight them down and to cool them as well. It is sometimes better, when possible, to weight a casting down than to try to straighten it by cooling. I have seen long awning castings go so crooked that it was necessary to take them out of the mould, lay each end on some pig iron and weight down the middle so as to bend it down more than an inch below a straight line, the bending being done the reverse of the way that it naturally crooked or warped. This should be done as soon as possible after the casting is poured, so as to bend it while red hot. When the castings had cooled and the weights were taken off they come up straight.

Often moulders will weight down the ends of a casting, and shovel the sand from the top in the middle in order to keep the ends of the casting from coming up. This is wrong, for by cooling the middle on the top side, this part is contracted quicker than the under side, which will naturally cause the ends to come up if the weights are not heavy enough to hold them down. If the moulder is trying to hold down the ends of his casting, it would look more as if he understood what he was doing to dig underneath the middle of the casting so as to cool it, which, by causing the casting to contract there, will help the weights instead of working against them.

If the under side cannot be got at, it would be better to put on more weights, and instead of cooling the middle on top, leave it well covered over with sand, so as to keep it hot. It should always be remembered that removing the sand or brick from any part of a hot casting cools it; that cooling any portion of a hot casting causes a contraction, and that the side that contracts the fastest becomes the shortest. Also that before one side can become shorter than another, there must be a crook or a bend in the casting, this bend being made while some part of the casting is hotter than another. The part that cools first will generally keep the casting in the shape it was bent when hot.

It is not always that a moulder will succeed in straightening a casting before it is cold. He may, when he gets it out of the sand, see that it is crooked, and while there is yet a little heat in it, by dampening the rounding side or surface with cold water, straighten it. This treatment requires care, especially if the casting is so hot that you cannot bear your hands on it. The action of the water is sometimes visible as soon as it is applied, and if care is not taken, the casting will be bent the other way, in which case, if there is heat enough left, it may be wet on the other side to bring it back.

After castings are entirely cold and are then found to be crooked, they may often be straightened by pening with a hammer, or by heating the middle with a wood and charcoal fire, and weighing down the ends.

The upper cut shows how this is generally done. The crooked casting is rested on two iron bearings, *E E*, high enough to give a good chance to build a wood fire underneath. There are then wooden or iron guide-blocks, *P P*, set to allow the ends of the casting, when it is being straightened, to be bent down the proper distance, so that, after the weights are taken off, the ends will spring up, leaving the casting straight. It will generally be necessary, if the middle is made red-hot, to bend it down about twice as much as it is crooked; that is, if it is $\frac{3}{4}''$ crooked, it should be bent $1\frac{1}{2}''$, and after it is cold and the weights are taken off it will be straight. This is done by adjusting the blocks, *P P*, so that the weights will bend the ends down just as far as required.

In straightening castings in this way there is no cooling or contraction involved; the casting is simply bent, while red-hot in the center, by the weights.

The casting must be red hot and be bent more than sufficient to straighten it, as explained.

A wood fire is kept underneath, and a charcoal fire is made on top of the casting, so as to have it surrounded entirely by a strong fire.

Often castings can be made straight by pening the hollow side with a hammer as shown. The hammering compresses and lengthens the part that is hammered, expanding the surface of the iron, which lowers the ends.

A solid iron block should always be used to rest the portion of the casting under the hammer, and the hammer should have a good flat pene. The hammering should be done gradually over the surface. Steady hammering on one spot and then on another breaks the skin or surface of the iron, or perhaps worse, will break the casting in pieces.

The lower cut shows how gates and runners sometimes draw castings crooked. This casting was a long toothed rack, the teeth being small. The casting was gated as shown, and when it was taken out of the sand it was bent sideways. This was caused by the gates and runner being lighter than the casting, and in cooling and contracting the quickest, they drew the casting crooked.

To remedy this in the next casting, gates were made on both sides as at *X X*, instead of on one side only. This caused an equal pull on each side, thereby making a straight casting. The small gates 2, 3, 4 and 5 at the ends would generally be broken from the castings by their rapid contraction.

There is hardly a foundry that has not been at some time troubled by castings breaking or warping, and it is frequently troublesome to find the cause, and a remedy.

An Eighteen-Foot Pulley Turning Machine for $700.

In many machine shops of moderate capacity the cost of a large fly-wheel pulley lathe puts its use in an economical point of view out of the question, since unless there is work to keep a high-priced tool of this class in something like constant use, it cannot be expected to pay. At the steam engine works of William Munzer, in this city, is a machine in which are turned all the fly-wheel pullies and balance wheels up to eighteen feet in diameter used by him in engine construction, and which, we are told, cost, all complete, $700.

In the construction of this turning mill, or lathe, or whatever it may be called, a pit of suitable dimensions was prepared in the usual manner. At each end of this pit is arranged a cross sill made by laying two I rolled beams together, fastening them with distance pieces between the stems of such thickness as to keep the flanges sufficiently apart to admit of using a bolt between them, and planing the faces of the flanges. On top of these sills are placed two similarly constructed longitudinal beams, or girders, which extend the whole length of the pit, or from sill to sill. These girders can be bolted on the sills any required distance apart, thus making a rectangular frame of four members, each member consisting of two bars securely fastened together, the whole answering in some degree to the bed of a lathe.

The pulley or balance wheel to be turned is keyed to its shaft, the journals running in boxes, one of which is bolted to the top of each girder. An arrangement at the end of the shaft for taking the end thrust adapts the wheel to be revolved in the boxes for turning; a plan of which it may be said that it provides for the running in truth of the wheel after it is turned and mounted in position with the engine.

Segmental gears made with a view to that purpose are bolted to the arms of the wheel to furnish means for driving it while being turned. (It may be remarked that these segment gears are provided in three or four sizes, so as to apply the power as near the part to be turned as practicable.)

A shaft extending into the machine shop—

the lathe is outside the shop proper—carries on its outer end a pinion to run with the segment gear, and on its inner end a worm wheel, driven by a worm on a shaft carrying a pulley for the driving belt.

A cross head with a tool block is bolted to the top of the girders, and a ratchet attachment for feeding completes the machine. An objection that with a heavy cut the girders would spring, was met by a reference to the work done on the machine, and also by the argument that if they did spring, everything—shaft, pulley and tool—went together.

This machine may not be equal to a modern fly-wheel lathe, but it does a good job and costs very little money, the interest on which is not burdensome when the machine is not in use.

Machine Attachments and Tools.

The accompanying engravings represent some machine attachments and tools, as manufactured by Wells Brothers & Co., Greenfield, Mass. One of these is a machine for grinding tools of any kind, especially fluted reamers and all classes of milling cutters, straight, spiral and bevel, or cutters with side teeth. For grinding lathe tools an extra wheel with special rest is provided. This machine is particularly adapted for use in the machine shop.

Another attachment represented is a friction clutch countershaft, in which the friction is brought about by forcing the hub of the pulley against a collar which is fastened to the shaft; an ordinary shifting lever being used for the purpose. The adjustment is made by means of a collar outside of the pulley. Two sizes of pulleys are used, 10″ and 12″ diameters.

A third device shown is a three-center attachment for a milling machine. This attachment has been made and used to some extent in their own works by different parties, but as improved is now made and sold as a regular article of manufacture. Its advantages will be apparent to the users of milling machines.

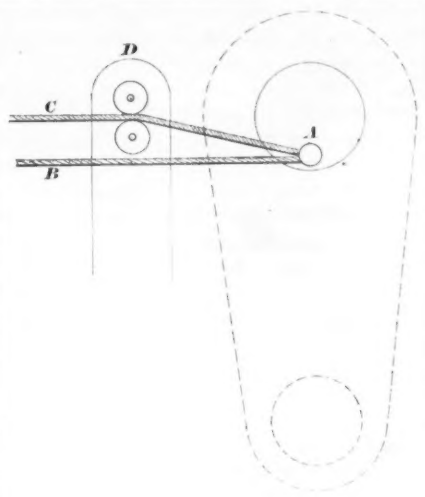
Neutralizing the Irregularities of Indicator Drum Motions.

By F. F. Hemenway.

In improvising means for giving motion to the paper drum of a steam engine indicator, it is generally difficult to hit upon an arrangement by the use of which that motion will represent at all points the motion of the piston of the engine. In fact it is seldom that the most elaborate arrangement, with plenty of time for consideration and for making the parts, is absolutely correct. Authorities on the use of the indicator are for the most part singularly careless in their statements in respect to this important point, frequently describing a motion as "correct," and in other instances leaving it to be naturally inferred that it is so, which at the best is but an approximation, and sometimes not a very close one at that. In instances within the knowledge of the writer, theoretical curves to demonstrate how nearly perfect expansion takes place, have been drawn on diagrams taken from a motion requiring no demonstration to show that it was anything but correct.

Sometimes the purpose for which the indicator is applied is such that considerable irregularity is admissible, always provided the drum motion at all times represents that of the engine piston in direction. At other times, when as for instance the indication is for the purpose of finding the exact power developed, or for accurately determining the behavior of the steam in the cylinder, particularly during expansion and compression, it becomes necessary either to obtain a motion exactly representing that of the piston, or if this is impracticable, to find the proper correction and apply it to the diagram.

Generally, a better way than to find this correction by drawing the relative progress of the piston and the drum motion in a sufficient number of positions, is by making a model of some thin strips of wood, and in

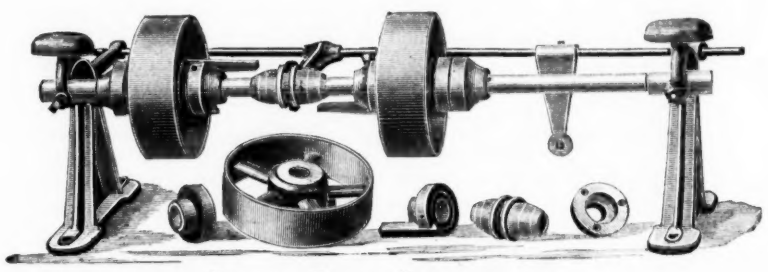


the absence of a table or smooth bench of sufficient size, mounting it on the floor. By this means a scale may be made that can be readily applied to all of the diagrams, which may then be "worked up" accordingly.

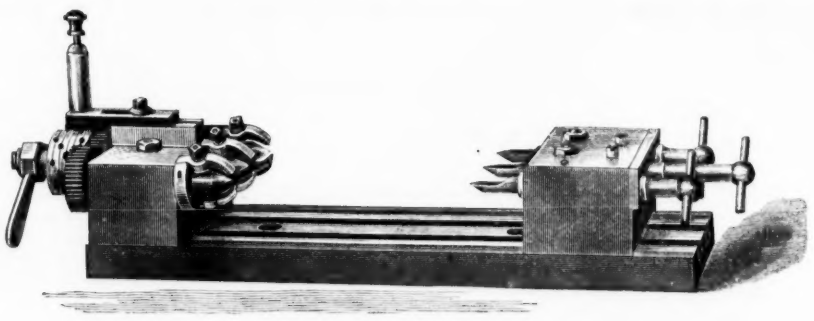
The writer had at one time occasion to indicate an engine to get the average power for ten hours' run, the construction of which was such that no means presented itself for reducing the motion to one suitable for the length of diagram without a good deal of trouble and considerable time and expense, except to take it from the end of the crank shaft. This was done by drilling a hole and inserting a pin, as at *A* in the sketch, in which *B* represents the cord leading to the indicator under a guide pulley near the cylinder. Owing to the effect of the angularity of the connecting rod, this plan introduces serious irregularities into the motion of the drum, their extent being greater than would be generally believed till after demonstration, and makes it absolutely necessary to find and apply the correction. As a ready means of doing this, the idea suggested itself of utilizing the engine in making a scale with which to set off the divisions on the diagram to correspond with definite and equal advances of the piston of the engine. This was accomplished as follows: The spring was removed, the indicator being left in position with a paper on the drum, and the cord hooked on. Putting the engine on the dead center a vertical line was drawn on the paper with the pencil of the pencil movement, the engine turned by hand in the direction which it run until the cross-head had advanced exactly one inch, and another line drawn, and so on, until the stroke was completed. The atmospheric line was then drawn, which finished the construction of a paper scale, with lines differing widely in their intervals, but which exactly represented the advance of the piston by inches.

From this paper scale a wooden scale was made, which was used in marking off horizontal distances on the diagrams, instead of the usual equal-spaced divisions, as under ordinary circumstances. From these divisions the power was calculated, the character of the expansion line tested, &c., &c.

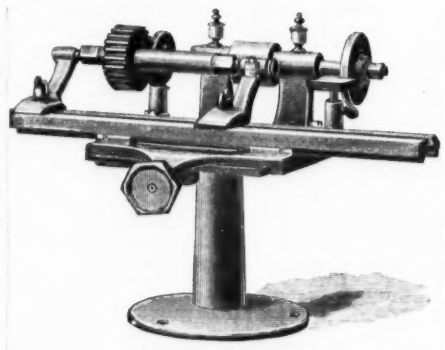
Having at another time occasion to indicate an engine similar in construction to this one, but at much higher speed, the throw of the cord (as it is apt to do when motion is taken in this way) interfered with the operation to such an extent that two small guide pulleys, shown at *D*, were put in position, and the cord led to the indicator, as at *C*. This was found to work quite satisfactorily, modifying the irregularities due to the angularity of the connecting rod, but, of course, not correcting them, the only point gained being the steadying of the cord and getting a smooth and accurate diagram (after correcting) instead of a rough and manifestly incorrect one.



Friction Clutch Countershaft.



Three Center Attachment.

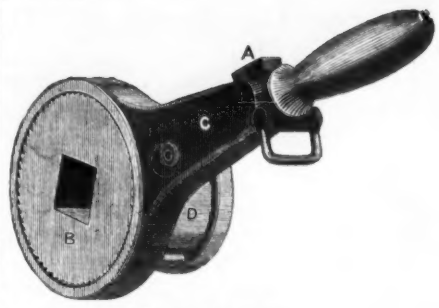


Cutter Grinder.

Improved Card Ratchet.

The device represented by the accompanying engraving is made use of in clothing cards on carding engines. The sheets of cloth are fastened to the main cylinder of the machine with tacks, the upper edge being tacked on first. It is of essential importance that the cloth be drawn very tight over the clyinder, so to do this the main cylinder is clamped to resist the stress brought upon it by the card ratchet and prevent it from turning. A clamp is then attached to the lower edge of the sheet and connected to the strap cylinder of the card ratchet.

The doffer, or small cylinder, is removed from the card, and a square bar is put in its place on which the card ratchet *B* slides by means of the square hole made to receive it. It is made an easy sliding fit, and is moved along as each section is drawn tight and made fast. The square bar is held stationary, and the handle with strap cylinder revolves around it, and when the sheet is drawn tight enough the pawl *A* catches and holds it while the sheet is made fast. Then, by a light pressure of the thumb, the pawl is disengaged and the strap loosened, after which the whole apparatus may be moved along for another grip, and so on, until the whole is accomplished. This ratchet is simple in construction, and easily handled, as but one hand is required to operate the ratchet while the other is used upon the clamps.



Card Ratchet.

The ratchet and pawl are entirely inclosed. The pawl is of wrought iron forged with a cast-steel point and hardened, being adjusted in the handle *C* in a most convenient manner. By loosening a screw in the strap cylinder *D* the ratchet wheel may be taken out and a screw in the handle *C* releases the pawl, thus freeing all the working parts. This ratchet is made by Wm. H. Redding, Millbury, Mass.

The Railroad *Gazette* of July 7th, has information of the building of 249¼ miles of new railroad, making 4,415 miles thus far this year, against 2,281 miles reported at the corresponding time in 1881, 2,190 miles in 1880, 1,008 miles in 1879, 691 miles in 1878, 689 miles in 1877, 740 miles in 1876, 426 miles in 1875, 680 miles in 1874, and 1,518 miles in 1873.

The "Midsummer Holiday" number of *The Century Magazine* has an interesting article entitled, The New Northwest, by E. V. Smalley. We make an extract:

"The two smart towns of Fargo and Morehead look at each other across the muddy Red River ditch with jealous eyes. They will not bridge the stream, because each is afraid the other would profit by a convenient crossing. Vehicles ferry over on a rude flat-boat, worked by hand-power applied to a rope stretched from bank to bank, and pedestrians are beholden to the railroad company for the use of its bridge. Morehead, the Minnesota town, has three thousand inhabitants; Fargo, the Dakota town, boasts of six thousand, and styles itself the Red River metropolis. Both welter in a sea of black mud in the season of thaws and rains; both are largely devoted to speculation in lots and lands, and both are equally unattractive to the eye. They are in reality a single town, commercially speaking, and a remarkably prosperous one, too. The railroad system has made them the business center and distributing point for the entire Red River Valley, and out of their present jumble of muddy streets, cheap pine cottages, and shanties, vacant lots, saloons, stores, and lumber piles, will grow up a handsome city of fifty thousand inhabitants within the present generation. Already there is a handsome hotel, rejoicing in the architectural oddities of the Queen Anne craze, a street railway, an electric light company, water-works, half a dozen banks, a daily newspaper, a number of creditable churches and school buildings, and a few pretty dwellings. Real estate speculation runs wild. Visions of a second change have turned the heads of the inhabitants. The talk is all about lots and values—how much this or that corner is worth, what Jones paid for his strip of mud, or what Smith holds his at. The real-estate agents have their offices in the hotels, in order to watch the arrival of guests and seize upon the supposed capitalist seeking investments, or the emigrant looking for a farm. No well-dressed stranger need wait long for the offer of a free ride about the future city and a valuable guide to explain the many choice openings waiting for him and his money."

According to *Engineering* the proposed connecting of the Rhone and the Loire rivers (France) by a canal contemplates the employment of Captain Eads' plan in carrying boats up two long inclines by means of railways. To prevent injury to the boats, they will be floated in iron cisterns resting on railway trucks. The trucks will be helped up the incline by the gravity of barges in an opposite direction.

Webb's Compound Locomotive.

A PAPER READ BY DAVID JOY, OF LONDON, AT THE AMERICAN MASTER MECHANICS' CONVENTION.

My subject is the compounding of locomotives as it has been carried out by Mr. Webb, the chief superintendent of motive power of the London and Northwestern Railroad Co., which is probably the largest railway in England. Perhaps I hardly need say that I am now speaking of Mr. Webb's work and not of my own. The credit or *éclat* of any advance here is his and not mine. I have, however, been furnished by him with all the information which I now have the pleasure of laying before you, in addition to which I have from time to time made myself familiar with all the work, riding on the engine and otherwise watching the progress of this improvement.

The question of coal or coke consumption with us in England has always been a very serious one, so that all devices for economizing fuel have received much practical attention.

Undoubtedly many of you are aware that in England, a few years ago, a commission was appointed to investigate and report upon the coal fields of England, and on this report to found an opinion as to the probable duration of the coal supply. I do not remember the exact figures, but the date of the exhaustion of the supply appeared to be uncomfortably near.

In presence of this contingency it is no wonder that devices innumerable have been before the English public, claiming to accomplish all that was required in the way of economy, but on the principle of the survival of the fittest, our English locomotives have retained nearly the old form in which they appeared thirty or forty years ago.

The experiments made in France and Germany, in the compounding of locomotives, have been before you in the mechanical papers. My province is to tell you all I can of what has just been done in England, and then to answer any questions that may arise thereon, so far as I am able.

About three years ago, when I first introduced my valve gear to Mr. Webb, he told me that he proposed to build a compound locomotive, with a view of economizing the consumption of fuel, basing his expectations on the great saving that has in recent years been made by the introduction of the compound system for engines at sea.

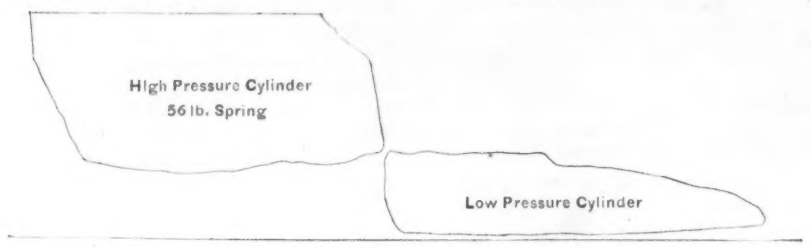


FIG. 1.

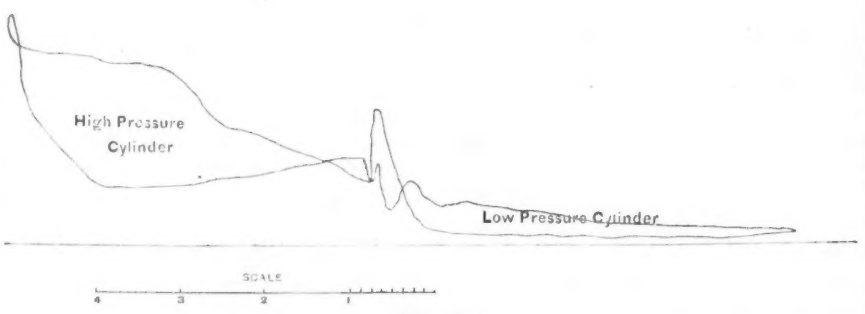


FIG. 2.

With very cautious and measured steps has the investigation of the question and the designing of the details been carried out, resulting in the engine of which blue prints and photographs are now before you.

Of this engine and the peculiar object aimed at by the divergence, in its construction and ordinary practice, I will now endeavor to give you a short, but, I hope, a clear description.

If you are at all acquainted with the standard express engine of the London and Northwestern railroad, you may fairly say, on first sight of the photograph before you [we show a cut of the drawing on this page] that the new engine has been a very slight departure, in appearance, at least, from such standard type. Such in reality is the case, and this is a great advantage, the real difference being one of total alteration of principle.

But, as you will readily see, if with the altered principle the details can to a large extent be retained, the change is not such a one as to prohibit or, in fact, militate against the introduction of the new principle.

In the new engine the same boiler, wheels, frames, etc., and to a large extent valve-gear and other details are retained.

Now, to describe the engine. As I have said, it has the outward appearance and wheel bearing of the ordinary four-coupled express engine. Only the trailing pair of wheels are not coupled to the driving wheels (using the usual nomenclature) but are driven independently by a pair of outside cylinders 11½ inches diameter and 24 inch stroke. These are fixed to the outside frames just in front of the driving wheels, where the sand boxes are usually placed. The motion bars are carried back beyond the driving wheels to a bracket from the frame, and these carry the valve and reversing gear, which is of the Joy type.

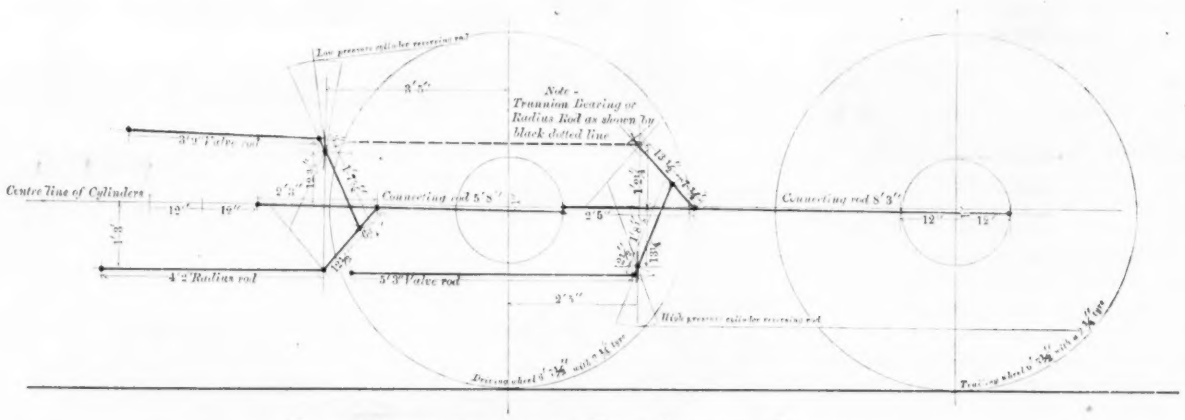
This pair of wheels so driven have their cranks set at right angles, and so far we have an outside cylinder engine with single driver behind the fire-box, but the exhaust steam from these cylinders is passed through a receiver formed of copper pipes surrounding the inside of the smoke box, where it takes up the waste heat from the tubes, and then passes to the low-pressure or expansion cylinder, the dimensions of which are 26 inches in diameter and 24-inch stroke. This cylinder is placed in the usual position for inside cylinder, viz., under the smoke box, and by a single throw crank drives the middle or driving wheels, the Joy valve motion being here also used.

Thus both pairs of wheels are independently and separately driven, and thus are combined all the advantages of the coupled engine with its disadvantages, and all the advantages of the single engine without the disadvantage of its liability to slip. In fact, for all practical purposes, you have two single engines coupled by the steam between them and by the rails beneath them. You also save the coupling rods with all their attendant evils, their liability to break at high speeds, rigidity and harshness in running around curves, causing skidding of either inner or outer pair of wheels, and so adding friction, the great souce of all wear and tear, and the prime cause of the necessity of repairs.

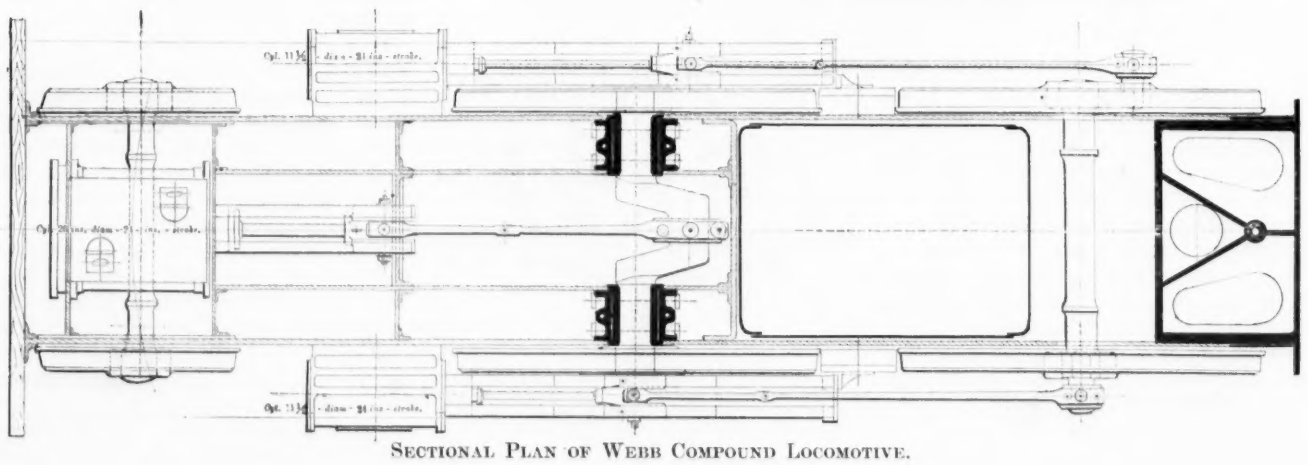
Next as to the handling of the engine. This is practically not different from that of the ordinary engine. There is not the least difficulty in starting, as the two high-pressure cylinders have their cranks at right angles; so far the engine is in the position of an ordinary locomotive, but there is, in addition, a valve at the command of the engine runner by which he can at will admit live steam direct to the low-pressure cylinder, thus giving him three cylinders to start with, though this is not found to be at all necessary. Meanwhile, the first exhaust from the high-pressure cylinders passing at once to the low-pressure cylinder on the enlarged area of piston, the full power of the engine is at once developed.

This power being divided between the two pairs of wheels, there is no more tendency to slip than with the ordinary four-coupled engine with the same weight on the wheels—indeed, much less, for continuous slipping is checked by each set of cylinders controlling the others. Thus, if the wheels driven by the high-pressure cylinder slip, they at once, exhausting into the low-pressure cylinder, check themselves by back pressure, while the surplus power thus passed over to the low-pressure cylinder, if enough to cause slipping, quickly exhausts that pressure and thus a balance is secured; and both sets pull equally, the action taking place being really an automatic preventive of slipping.

We now arrive at the main object in the designing of this engine, namely, the saving of fuel, which, as I have said, is with us a precious commodity. When I left England at the end of May last, this engine, after some desultory general work, had been working continuously during the month of April, running the Irish mail on the London and Northwestern Railway. The train usually (from its speed) called the Wild Irishman, had scored to the end of April about 7,000 miles. Its daily work from Crewe to London and back is about 336 miles. The average load on the up journeys is 8.3 carriages of the London and Northwestern large 6-wheel type, each weighing about 12 tons, or without engine or passengers about 100 tons. On the down trip the average load was 11.2 carriages, or about 134 tons.



VALVE MOTION DIAGRAM OF WEBB COMPOUND LOCOMOTIVE.



SECTIONAL PLAN OF WEBB COMPOUND LOCOMOTIVE.

The greatest load the engine has taken was 16 carriages, equal to a total load, with engine, of 260 tons (English). Running at Northwestern railway speed, the figures of which I regret not to have with me, but which are not much under Great Western railway speeds, the quickest of which is the "Flying Dutchman," 76 miles in 87 minutes.

The average consumption for the month, including lighting fires, was 23.2 lbs. of coal per mile, as against the ordinary engine minimum of 30 lbs. per mile doing the same work.

This, I think, may well be considered a satisfactory result for a first month's working, for we may well assume that, under such circumstances, the best result attainable has not been accomplished.

The following data apply to the indicator diagrams shown in connection with this paper, and reproduced above.

Fig. 1.—Speed about 5 miles per hour; boiler pressure, 150 pounds; steam-chest pressure, 43 pounds; reversing lever, full gear forward.

Fig. 2.—Speed 60 miles per hour; boiler pressure, 148 pounds; steam-chest pressure, 35 pounds; reversing lever, fifth notch; gradient, 1 in 338, up.

Diagrams reduced by photographing; scale attached.

Lubricating Cylinders.

A DISCUSSION AT THE RAILWAY MASTER MECHANICS' CONVENTION.

Mr. Howard Fry presented the following question: What lubricant is best for locomotive cylinders, and how much lubricant per mile should a locomotive use for all purposes?

MR. FRY.—The lubrication of the cylinders of a locomotive affects very materially the amount of lubrication that is used altogether, the cylinders taking a very large proportion of the total amount necessary for the whole engine. A short time ago I noticed that one division of the Lake Shore Railroad was materially lower in its consumption of lubricants, not only than any other division of that road, but than any division of any other railroad I am acquainted with. It seemed to me very remarkable that a division of the Lake Shore, which is one of the most dusty roads that I know of, should have so greatly reduced the consumption of oil for locomotives. It argues either that they use a much better material than we do, or else that they have given a great deal more attention to the subject. I think a pint of lubricant was consumed per 26 miles, including tallow and oil and everything else.

MR. SEDGLEY.—Mr. Fry has referred to our road. I would simply state that we are using a treated oil for lubricating our locomotives, and I do not think we are doing as well as we ought to do. Mr. Fry referred to our Erie division where the mileage was about 26 or 27 miles to the pint. This division, four or five years ago, was making perhaps 9 or 10 miles to the pint of oil, but by close attention and by talking to the men they gradually brought the mileage up without any detriment to the engine. In fact, it is a benefit to the engine. I will say for the information of the members that our mileage was $20\frac{55}{100}$ to the pint of oil last year, which was below the average. It was a very severe year, and we were double tracking a large portion of the road. That means extreme service, and the cost per mile run, for lubricating our engines in 1881 was one-fourth of one cent per mile. We use earth oil. I would qualify that by stating that I presume there is a mixture of animal oil in the earth oil; but we use a treated oil. We have been using it for some four or five years, and we use nothing else. The men know what they are using. My own judgment is that we ought to make 25 miles to the pint of oil. The cost of the oil we use is $5\frac{18}{100}$ cents per pint

MR. HAYES.—Does that include oil used in your headlights, lamps, etc.?

MR. SEDGLEY.—It does not. I simply take the lubricating oils.

MR. HAYES.—I would state that for the last two or three years our oil has cost us 30 cents to the 100 miles. That includes all the oil—the headlight, cab lamp, lamps of the engineeer and fireman, and signal light, when they carry one. Our average for lubrication alone is over 25 miles to the pint.

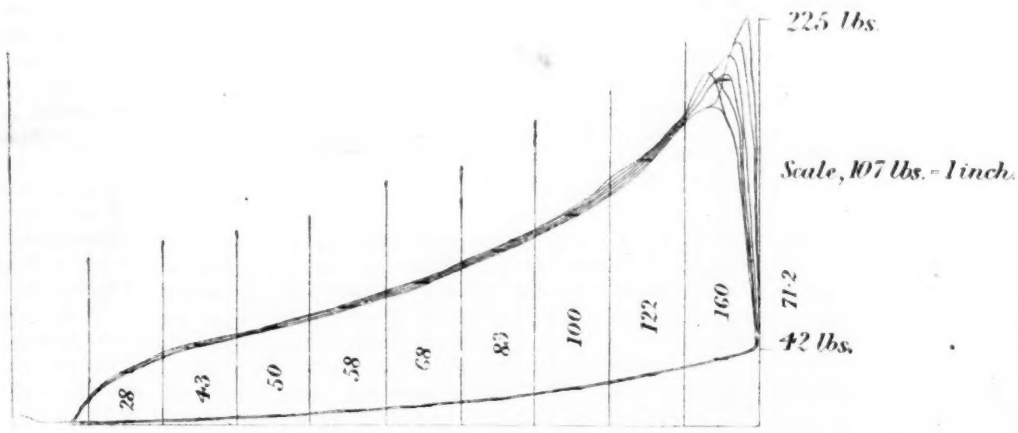
MR. CLARK.—My experience has been much the same as Mr, Hayes', as to the cost of our oil. My cost is about 33 cents to the mile. For the lubrication of cylinders I have tried several cylinder oils, and have never yet been able to get one to give the same results as tallow. Of course there are drawbacks to tallow, but taking it all in all, I still prefer it. We use 4 pounds to 200 miles.

MR. FRY.—The figures mentioned by Mr. Clark seem to me to be about the average of most roads.

MR. SETCHEL.—I understand that Mr. Sedgley uses the same kind of oil for lubricating as he does in his cylinders.

MR. SEDGLEY.—No, we use a different oil.

MR. CLARK.—May I ask Mr.Sedgley what this cylinder oil costs him?



INDICATOR DIAGRAM FROM THE CLERK GAS ENGINE.

MR. SEDGLEY.—Speaking from recollection, perhaps in the neighborhood of 45 cents per gallon.

MR. HAYES.—I would like to ask Mr. Sedgley about what is his average mileage per pint of cylinder oil?

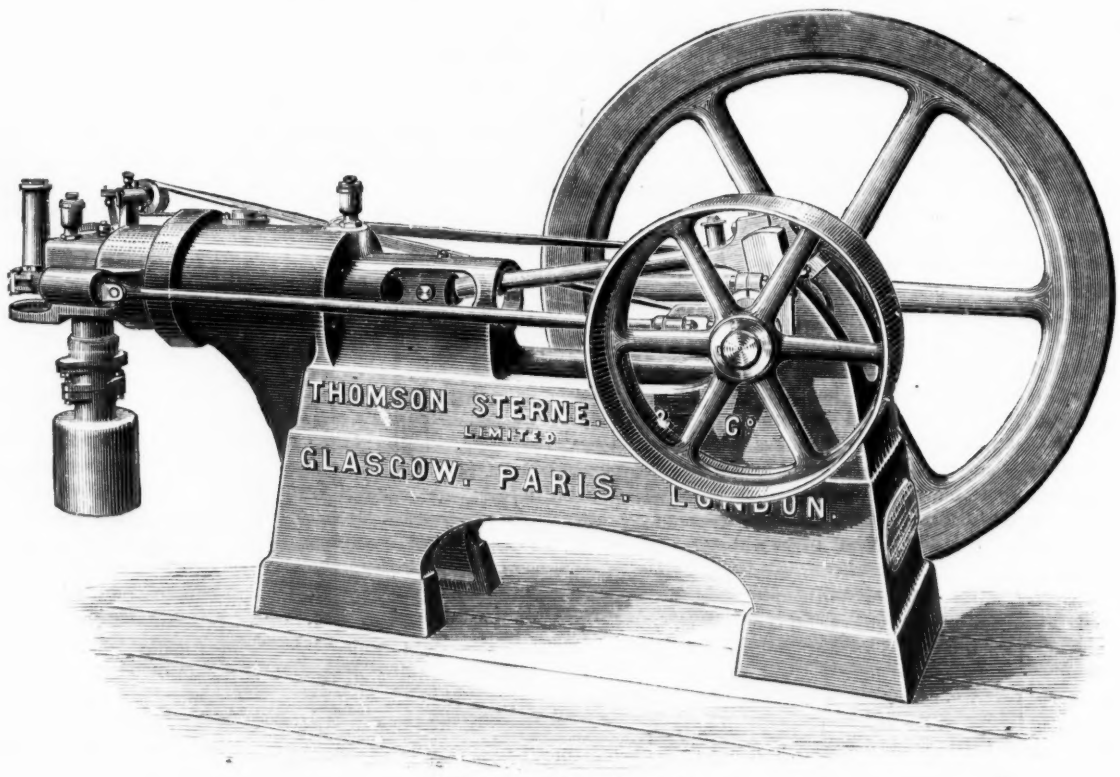
MR. SEDGDEY.—I cannot answer that question, because in making up the statement, they were both put together and I could only approximate it. I give you the aggregate cost of lubricating the engine, including the cylinder

MR. SEDGLEY.—I am using the same brand of oil as you are, and our average for cylinders is about 60 miles to the pint. Some of our men will run as high as 100. Taking the whole road, it is about 60 miles to the pint for cylinder oil. It is a composition, as I understand it, of neatsfoot and common oil. I don't know what the proportions are; but we pay 58 cents a gallon for it delivered in Chicago, and we find it gives better satisfaction than tallow.

MR. WILDER.—How does it compare in the matter of economy with tallow or any other lubricant which you have used for the cylinders?

MR. HAYES.—It costs about the same per mile as tallow; but we get rid of the eating and other deposits left by the tallow or lard oil, that have been accumulating in the cracks and corners in the ports, and all about the cylinders and steam chests, and cleans them out.

MR. SHAW.—After two years' experience with the oil, Mr. Sedgley recommended me to use the same on the Canada Southern. Our expenses are, of course, heavier on the other side of the line, because we have to pay 20 per cent. duty to get these oils across the border. Our mileage last month was 72.5.



THE CLERK GAS ENGINE.

The Clerk Gas Engine.

We illustrate herewith a gas engine made by Thomson, Sterne & Co. (limited), at the Crown Works, Glasgow, Scotland, the performance of which is highly spoken of by leading foreign technical journals.

This engine, which is the invention of Dugald Clerk, is essentially different in some of its features from the ordinary type of gas engines, one distinctive feature being that an explosion takes place at each revolution. The engine, besides the usual working cylinder, valves, &c., is provided with an additional cylinder called the displacer. In this second cylinder the piston is driven from a crank pin in the fly wheel, this pin being set quartering with, and in advance of, the crank pin of the working cylinder. The piston of the displacer, in its stroke in one direction, acts as a pump, drawing in the explosive mixture (gas and air) during the first half of the stroke, while during the second half the communication with the explosive is cut off and pure air alone admitted. On the return stroke the contents of this cylinder are compressed till the piston of the working cylinder arrives at the end of its stroke, when the exhaust port (of the working cylinder) is opened for the escape of the products of the last explosion preparatory to its receiving the next explosive charge. It will be remembered that the last to enter the displacer on its receiving stroke was pure air, so that now when the communication between the two cylinders is opened the air (from the displacer) is first allowed to enter the working cylinder, cleaning out the dirt and gum, and carrying it out at the exhaust. At this time the exhaust is closed, and the explosive, following the air, is confined in the working cylinder, where it is compressed by the return of the piston to about four atmospheres. The working piston having now arrived at the commencement of the stroke, the mixture is exploded, the pressure rising to 225 pounds and expanding down, as shown in the diagram. The mixture is exploded by means of a small slide and a Bunsen burner, which will operate successfully 300 times per minute. An idea of the character of the explosion, with reference to time, may be inferred from the diagram, which was taken from an engine having a $6'' \times 12''$ working cylinder, with a $6'' \times 18''$ displacer cylinder, running at 150 revolutions. This engine, it is said, developed 9.15 I. H. P. on a consumption of 21.8 cubic feet of gas per I. H. P. per hour.

The especially novel features of this engine are the explosion of gas at each stroke, the arrangement of the two cylinders, and the means taken for cleaning out the working cylinder before the admission of a new charge, thereby removing not only dirt that is present, but also sparks that might bring about premature explosion of the charges.

Samuel Barrett, Jr., 4 Westminster Chambers, Victoria St. London, England, has commenced the preliminaries for a Mechanical Engineering and Metal Trades Exhibition to be held in 1883 in that city. All kinds of tools and workshop appliances will find a place in the exhibition, and various processes and manufactures in metal will be shown in operation. If carried out according to intention the exhibition will be especially interesting and instructive.

The Glasgow *Engineer* says: "Mr. A. Wagner, of Radevormwald (German patent), places inside the chimney a door which is kept open by means of a stick. By the great heat of the fire a piece of metal which is fastened on the door expands, and by means of a lever causes the stick to fall from under the door, which closes like a trap, and prevents all passage of air through the chimney."

An improvement on the above method would be in applying fusible metal fasteners to the door upon the principle of the various patent fire extinguishers used in American mills and factories. A metal could be compounded so as to fuse and release the door at the proper degree of heat.

Under the head of "Fire Escapes," one reported in the industrial statistics of the State of Pennsylvania is: "Permission to jump out of the window."

LETTERS FROM PRACTICAL MEN.

Rolling Mill Couplings.

Editor American Machinist:

I send you herewith a plan of the crab coupling and leading spindle just put into use at the works of the Springfield (Ill.) Iron Company for driving a 12-inch roll train. The fast crab is shrunk and keyed solid on the outer end of the main shaft of a 20″ by 30″ Hartford engine, and the spindle takes hold by the usual "wabbler end" of the middle pinion.

This "wabbler" form of coupling has been used in rolling mill machinery from a very early date, but in spite of its very obvious utility in other lines of similar work, it is too little known to the mechanical world outside of rolling mills. It has little to commend it save a real fitness for the place it holds, for all the parts go into use rough from the foundry, except the fast crab, which must be bored and keyseated.

This particular coupling is transmitting work from the engine, varying from the friction load of the train 70 H. P. up to 379 H.P., which is the highest limit yet observed.

The dogs on the coupling are made square on both faces, so that the train can be backed if needful, and with broad surfaces so that the wear shall be the least possible. The fluted outline of the hole for the driving spindle is clearly shown. The loose crab and the coupling box are held apart from each other, when slipped along into their working position by oak stretchers, laid in the grooves in the driving spindle, and kept in place by a leather strap around them. The small end on the spindle permits the whole coupling fixture to be readily dropped into place, while at the same time it prevents the spindle from moving endways.

This type of "wabbler" coupling apparatus, if made of strong, hard iron, with close foundry fits throughout, will transmit a very high limit of power at high speed when needful, with trifling wear upon the surfaces; it can be uncoupled in the least possible time, and costs nothing whatever for fitting.

Peoria, Ill. P. BARNES.

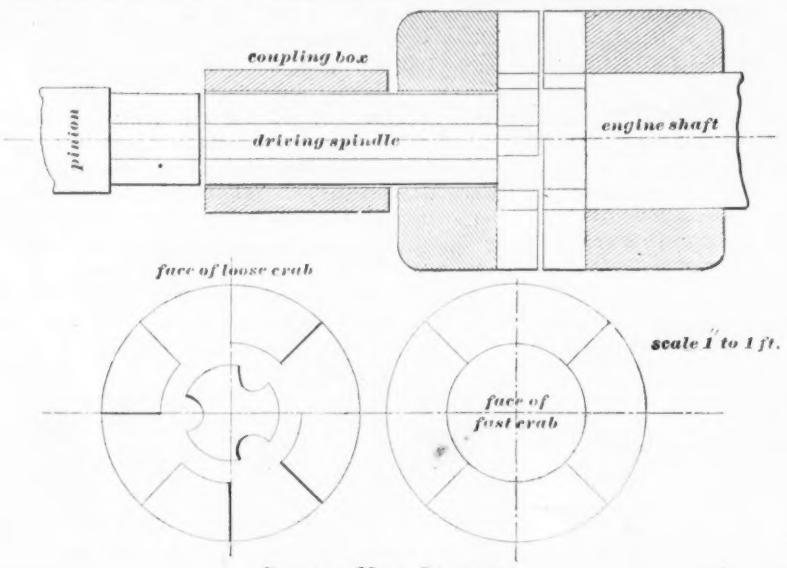
Measuring Instead of Gauging.

Editor American Machinist:

By the report in your issue of July 22d, it appears that the railway master mechanics have decided to *measure* instead of *gauge*. That this is a step in the right direction all who have adopted this plan are convinced, while all others who investigate intelligently must eventually see the advantages. As an evidence of the firm conviction that a *gauge* must be used, it is interesting to note the fact that an argument was necessary to settle whether the micrometer caliper is a *gauge* or a measuring machine.

Having advocated the use of this measuring machine (not gauge) for many years, the writer would like, if possible, to speak such words in favor of measuring as shall induce those who persist in using the old sheet metal and wire gauges, and spring calipers, and rules, for close measurements, to look into the matter more closely.

How can the absurdities of the gauging abomination be shown in stronger light than by recounting some of the actual occurrences in every-day practice? A party getting an order for tools adapted to do some special work on No. 3 wire is obliged to inquire: "By what gauge?" the answer being, "By Stubbs' gauge;" the tools are completed, but have hardly reached their destination when it is learned that they are not right. To the question put to the superintendent who says they are wrong: "What gauge have you there?" is answered: "We use all sorts of gauges; some with niches, some with tapering slits, some Stubbs, some Washburn & Moen gauges, and all sorts." To the suggestion that as the tools in question were made to suit Stubbs' wire gauge, it is unreasonable to expect them to correspond with the Washburn & Moen gauge by which he is testing them, comes the reply: "There is not much difference anyhow; all the gauges are about alike." Not much! Only .015″ between the list size by which the tools were made and



ROLLING MILL COUPLING.

that which they are condemned for not fitting, while if the objector had chosen to test them by the American or Brown & Sharpe gauge, the difference would have been twice as great, or nearly one thirty-second of an inch.

Now just here is the very pith of the whole matter. Without the micrometer or a knowledge of its use, and the benefits resulting, these differences between gauges and measurements are treated as slight. The wire drawer speaks of them as quarter or half numbers, while that class of mechanics who measure in the old way apply the terms sixty-fourths or thirty-seconds, meaning to them very little, while they know if they reason upon the matter at all that they cannot in their way measure them.

On the other hand, the man who has learned the use of the micrometer caliper, or Vernier, looks upon a difference of a thirty-second as a great deal. To him it is not simply *one* division of an inch, *one* thirty-second, too small to make much difference, but it is thirty-one and one quarter parts of an inch, and he holds in his hand the means of measuring these parts accurately. He has learned the value of .001″ and knows that the difference of one thousandth of an inch is a difference which will, if added to a journal of the right size, cause it to heat and become abraded in running. In a word, he knows that it is the difference between a fit and no fit. He can measure quarter inches a thousand times a day every day in the year, calling the measurement .250″, and the variations for the whole year of the different measurements would hardly aggregate one one-thousandth above or below the exact measurement aimed at. This plan not only provides means for close measurements, but magnifies what has been treated as too insignificant to be considered, until the true value of even so small a division as .0001″ is apparent, and the strongest recommendation—one which should lead to its universal adoption—is that in the use of the micrometer caliper for making close measurements ordinary intelligence stands in place of skill.

While it is true that some of the best mechanics can measure very closely with ordinary calipers, it has taken years of practice to acquire that deftness of manipulation and delicacy of touch which distinguishes a variation of even one thousandth of an inch; but with the micrometer caliper any person may learn in one lesson, with no previous mechanical education, to measure more closely than by years of practice with gauges. This implement is confined to no particular use. With it may be measured sheet metal and wire, or paper and twine. No machinist should be without one, and any machinist who has not used one will, if he gets one and uses it a month, wonder how he has got along without it. With plenty of these little truth-tellers in a shop, the "pretty nears" and "leetle scants," and "fulls," and "leetle stiffs, but will be all right after running a while," and sundry and divers other expressions which hide an immense amount of bad work will vanish.

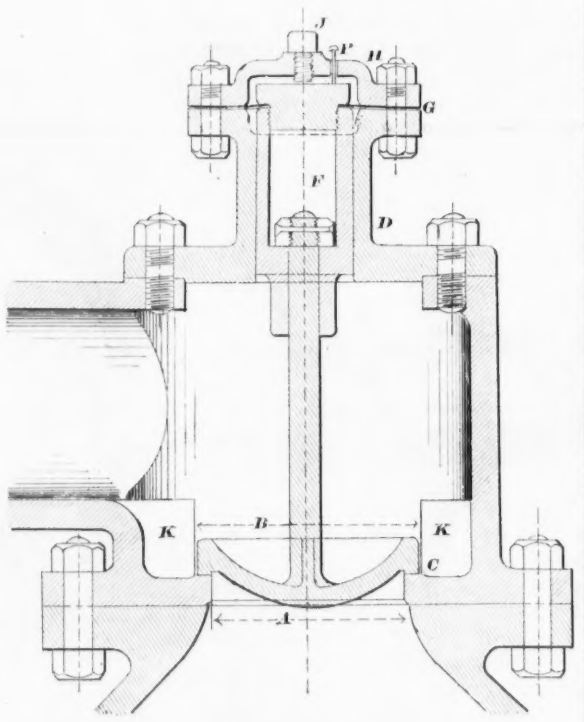
S. W. GOODYEAR.

Waterbury, Conn.

A Discharge Valve.

Editor American Machinist:

The publication in the AMERICAN MACHINIST of a recent issue of a poppet valve having



a spring face, designed by Gram Curtis, brings to my mind a discharge valve which I designed some years since, and of which I inclose a sketch, hoping it may interest some one, or perhaps be in some way of service.

The ordinary discharge valve cannot rise until the pressure underneath, multiplied by the area of the exposed part of the valve (as at *A* in the engraving), equals the pressure in the receiver, multiplied by the area of the valve at *B*. There is always considerable difference between these areas; hence, the pressure against the piston must always considerably exceed that in the receiver before the valve unseats to let the contents of the cylinder into the receiver or pipe, as the case may be. To design a valve that would lift as soon as the pressure in the cylinder equaled that in the receiver was the problem, and, so far as I know, the plan submitted is new.

The exact area of the annular seat *C* is ascertained, and the counter-bore *E* in the cap *D* is made large enough in diameter to have an equal area, *less*, say 5 per cent. The diameter of the piston *F* may be somewhat less, as shown, with a cap screwing into it at top, tight down on a diaphragm of copper *G*, the whole covered over with a bonnet *H*. The safety screw *J* is to prevent the piston rising more than is necessary to simply unseat the valve; a stem *P*, through an easy-fitting hole, shows when the device is doing its work properly. The piston *F* has a groove in the direction of its length to make sure that the pressure will act on the copper diaphragm. Three or four wings *K* are cast around the seat as guides for the valve at its lower end, while the piston *F* acts as a guide at the upper end. Its operation is as follows:

The pressure above the valve is constantly operating against the bottom of the piston *F* and the under side of the diaphragm *C*, with a tendency to lift the valve equal to the pressure exerted upon the annular seat *C*. As soon as this constant pressure is augmented or assisted by the proper pressure from beneath, the valve is balanced and unseated, and the office of the balancing device is at an end until the next stroke.

This is simply the crude idea, and could be incorporated in inlet steam valves of the poppet type, and otherwise modified to suit circumstances.

The use of a diaphragm of copper in the peculiar way shown has been introduced largely in the balancing of common slide valves.

JOHN A. CALDWELL.

A Yankee Notion.

Editor American Machinist:

Your letters from practical men are, it seems to me, one of the best institutions in the American mechanical press. I know that I have received great benefit from them, and trust that others have.

It might not do any harm if we had a little humor occasionally, so here is an incident that happened in our shop a few weeks ago.

JOE.—"I believe that emery wheel would wear better if it was put on the other side out."

But Jack spoke up. "Joe, didn't you know it won't do to put that wheel on the other side out?"

JOE.—"Why?"

JACK.—"A buzz saw won't cut backwards; the teeth would all be hooking the wrong way."

Joe thought he saw the point, and the wheel was not changed.

I used to have considerable trouble to hold the spindle of a hand lathe which had no back gears, when I wished to remove a chuck or face plate which had got wrung on, but after making the holder which I now describe I had no more trouble. I procured a piece of belting of the same width as used on the lathe, and about 6″ longer than enough to go around the large cone. I also got a piece of board, about two feet long, one end of which I fashioned into a handle; to the other end of this lever, which should be of about the same width as the belt, I firmly nailed one end of the belt, allowing 4″ lap. Then, to the other end of the belt I laced in an eye, like those used on the traces of a heavy harness, putting through the lever a hook-bolt with the hook on the same side as the belt, for the eye to hook on to.

It will now be seen that if the free end of the belt be passed under the cone from the front side, and then brought over and hooked fast on the lever, by pressing on the handle you have a regular friction brake, and which I never knew to slip.

CHARLES S. BEACH.

Hoosac Falls, N. Y.

Taper Journals on Lathe Spindles—Abuse of Tools.

Editor American Machinist:

Speaking of taper journals for lathe spindles, we have a lathe made for brass-work with hardened taper journals that has been running constantly nearly ten years, and there is no perceptible wear, although it is driven at a very quick speed. There is so little friction you can almost blow it around, the result of hardened and accurately ground journals and bearings.

An argument in favor of taper journals and sleeves is that they will keep the centers

of the same height and the live spindle parallel with the ways, the wear being endways. Parallel journals and boxes tightened by binding screws, as the boxes wear, throw the spindle out of line, causing the lathe to bore a taper hole; besides, the live and dead center do not agree.

As against conical journals, it is said that they are too refined for the present class of workmen; that the average "rushing" latheman has not the patience to adjust the bearings so finely as has to be done, and that they are expensive to make.

To be sure, a good deal of the disagreement of centers is the result of carelessness. I have seen a boy turning bolts, in his eagerness to do a big day's work, cutting the threads with the dead spindle out five or six inches, and not tightened, the center bobbing up and down. He gained about five minutes a day by not stopping to tighten the spindle, and ruined a good lathe. Of course, with such usage you will not find the centers on any lathe, however constructed, to agree.

The fact is, the wear and tear of machinery is apparently not taken account of. I have seen a "Horton" chuck tightened by putting on a wrench, and then "whacking" it with a hammer. It don't pay to put poor men to work on first-class tools.

A good deal of fault is found with a gear feed for a lathe, but it seems to me to be simple, not likely to get out of order, and it is easily oiled.

JOHN K. CANNON.

Fort Wayne, Ind.

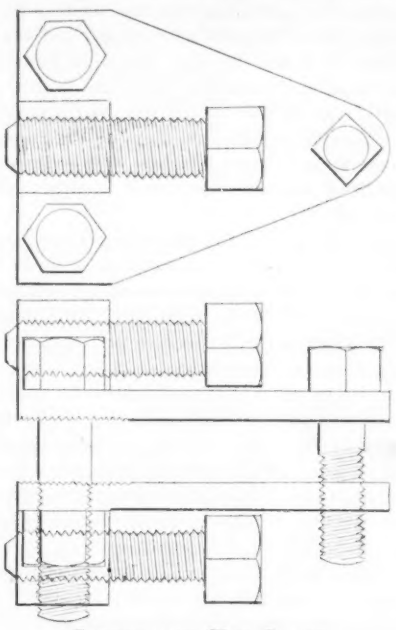
A Corrugated Key Clamp.

Editor American Machinist:

The accompanying sketch represents a pair of corrugated clamps for drawing keys from wheels, pulleys, &c., on the end of a shaft, where a drift cannot be employed, or for using in connection with a drift when the keys are found (as is generally the case), inclined to "stick." The parts which should be made of steel consist of the two clamps, with the ends grooved, or scored, as shown, to bite the end of the key, and five bolts. The ends of the clamps should be hardened. The clamps are adjusted by the three screw-bolts shown, and when set firmly on the key the bolts, shown as passing through the lugs on the clamps, are screwed hard against the hub, of the wheel, or the end of the shaft. By the use of a little judgment in getting the teeth of the clamp well imbedded in the key, a hard pull can be got.

N. A. NEILSON.

Chicago, Ill.



CORRUGATED KEY CLAMP.

One Week in the Mexican Navy.

BY AN ENGINEER.

The writer is not aware of the present condition of the Mexican navy, but at one time he could, as he believes, allude to it as "all of which he saw, and a part of which he was."

As this reminiscence relates to engineering under difficulties, and in part to the closing scenes of that ill-fated empire, erected by foreign powers in the land of the Aztecs, it may interest your readers.

The time, was seventeen years ago, and the place, the Rio Grande.

The empire of Maximillian, although supported by the French and Austrian contingents and the French fleet, was tottering to its fall.

The revolted states (known as the liberals), had instituted a republic, elected a president, organized an army, and were steadily gaining ground.

The sympathy of our government, and the army and citizens on the border, was strongly with the new republic, although the subsequent fate of Maximillian was generally and justly deplored. The liberals had surprised by night and captured the town of Bagdad, at the mouth of the Rio Grande, and the French fleet outside the bar was shelling the town with the view to recapture. Forty miles up the river the city of Matamoras was held by an imperial garrison, with two gunboats in the river. The fleet of heavy frigates could not cross the bar, but it was evident that a combined attack of the fleet at long range, with the launches, and with the gunboats in the river, would crush the liberal garrison as between the upper and the nether millstones; hence, the necessity of organizing some assistance on the river at once.

With this for the situation, a friend and the writer arrived at the river on a brief visit of curiosity, and were solicited by the Liberal Government to organize the assistance. As to their fitness, events were pressing, one had dabbled at engineering, and they could "set a squadron in the field" if not upon the sea.

For a vessel, several merchant steamers, deserted in the general confusion by officers and crews, were tied up at the piers, from which they were empowered to choose. For armament, they had the choice of the artillery in the town; and for men, a picked detachment from the liberal army was turned over to their command.

The first selection, with a view to speed, (for a reconnoissance up the river) was a small tug propeller, with a single, vertical, oscillating, non-condensing engine. It had a plain slide valve and eccentric, and the exhaust was led by annular passages around the cylinder to the opposite trunnion, and although this whole arrangement is not considered as "good form," it was excellently well adapted to this craft, as it brought the weight and all the machinery below deck. The cylinder and propeller were large in proportion to the boat, and her speed was remarkable.

In a short time steam was raised, the engine prepared, swung from the pier and headed up the river.

She had fairly got under way, and while yet in range of the guns of the fleet, the engine suddenly slackened speed and directly stopped altogether. A hurried examination of the engine showed no cause, and it was soon found that she had wound a rope cable, stretched in the river under water, tightly around her propeller. The cable was grappled, cut, a purchase on deck rigged to the free end, the engine reversed, and in a few minutes she was all clear and on her course.

If it should appear as ridiculous for a steamer to wind her propeller in a sling in this manner, it may be remarked (without the thought of disparagement) that a gallant gunboat of the United States navy once wound her own chain cable on her propeller, and dragged off to a dock under sail. The official staff of the gunboat Huron (in 1862) will appreciate the allusion.

But our tug was not a navy, for she had neither an armament nor a flag, and having made the trip she was returned to her pier to await the demands of commerce, and the force was transferred to a larger steamer more suitable for a gunboat.

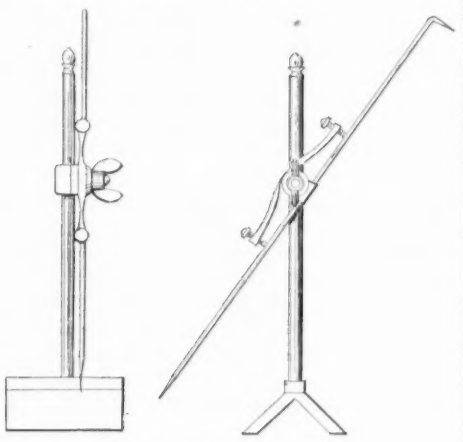
As to what a tug may do, with a suitable gun (say a long and light rifle, which we could not obtain), an example may be given. It was the fortune of the writer to see the capture of Port Royal, when Admiral Dupont swept away in a moment all the traditions of naval attack, by fighting his fleet under steamway and on a circle. There was in the fleet a little black tug carrying one gun, and too small to have a place in the line. She ran clear past the works, and while the heavy ships were engaged in front of the forts as they came in range, she delivered her deadly enfilading fire upon the guns and gunners of Fort Walker.

Our new venture was an English-built paddle steamer, with iron hull and single vertical condensing engine. The crew was increased by another detail from the army, guns and ammunition were taken on board, and then we were a navy, and the flag of the young republic floated on the Rio Grande.

A respect for truth obliges us to admit that the guns were six-pounder field pieces, and while I am not prepared to fully recommend them for naval purposes, it was observed in their favor that they could be readily moved about the deck, had a wide range of fire, could be fired over the rail, required no ports, and were of convenient height for rapid working.

It was an inconvenience that the two American officers, and the crew, with but two or three exceptions, did not speak or understand a common language, and some incidents were hardly naval; as, where a part of the boxes sent on board from the captured arsenal, supposed to contain fixed ammunition, were found, when opened for inspection, to contain chopping axes.

As showing the sentiment of the border, and the temper of those times, it may be remarked that when our boat appeared upon the scene, the citizens felt aggrieved that the two imperial gunboats should be allowed to remain longer afloat, and one dark and stormy night we received a visit from an American merchant who offered as a bounty to our boat, one thousand dollars in cash if we would run out over the bar to a point on the coast, obtain a long rifled gun, and run up in the morning and sink the gunboats, and because his offer was declined, it was learned that he bitterly deplored the conservative character of the new navy.



NEW SURFACE GAUGE.

That a gunboat should be improvised in a day from a merchant steamer, and by men not bred to the sea, may appear as incongruous, but is not wholly without precedent, for we are informed by Macaulay that, prior to Charles the Second, naval battles had been fought and won by officers of the English army, and to tack to port, there had been heard in the fleet the order: "Wheel to the left."

For the encouragement of those who may hereafter organize navies, we may say that our craft was satisfactory; her engine was a model, the men were trusty, and the service received the thanks of the Mexican authorities. The reader may now surmise from the title of this recital, that in a few days our boat, during a probable combined attack of the hostile ships, went down in a blaze of glory, fighting her guns to the last shot; but such was not the fact, for two reasons: first, that it was found that the imperial policy was defensive rather than aggressive; and, second, at the end of a week an officer of rank in the American army appeared upon the scene, and ordered the two Americans to report immediately at a designated point, to await the findings of a military tribunal. This was a fatal blow to our naval ambition, but it admitted of no question or delay, and hastily banking our fires and filling the boilers to third gauge, we turned over our boat to the Mexican authorities, and bidding adieu to the Mexican navy took up our lonesome march on the shore of the Gulf for Brazos, Santiago.

As ours is a most beneficent government, and as the navy we had organized for a foreign power was (like the baby in the story) "such a very little one," the penalty for our indiscretion was neither prolonged nor severe.

As the Mexican authorities whom we met have been introduced in this narrative, it may be but just to say that they appeared as earnest and determined men, who had staked their lives and fortunes in the revolution they were directing.

If this recital shall interest your readers it will mainly serve its purpose, although it may be considered in part as a straw, indicating a discussion as to the present condition and future demands of the American navy.

Derry, N. H.

New Surface Gauge.

The cut of a surface gauge herewith presented, represents one recently brought out by Mr. Smith of Hyde Park, Mass., for a drawing of which we are indebted to F. N. Isham, of the same place. The peculiar shaped base is to adapt it to lining and setting rods, shafts and similar parts of machinery as well as plane work. In setting work on planer, drill press or lathe, the work can be put in line and also leveled. The two thumb-screws provide for very fine adjustment of the indicator points. The general features of the tool can be clearly seen in the engraving.

Maintaining a Channel in Navigable Rivers.

M. J. Adams, the inventor of a plan for maintaining a navigable channel in large rivers, is about to test the merits of his invention on a sand bar in the Mississippi River, at St. Paul. His plan, which looks feasible, contemplates the use of a triangular shaped pipe divided longitudinally in two chambers. This pipe is laid on the bottom of the river, for the whole length if necessary, and into the upper chamber water is forced by means of pumps to the pressure of, say three atmospheres. The bottom chamber is divided in sections, into any one of which the water may be let from the upper chamber by suitably arranged gates. The bottom chamber is pierced at regular intervals with holes through which the water is forced with a velocity due to the pressure, cutting up the deposit which will be floated by the current and finally deposited where the water is still and deep.

It is claimed that by the use of this invention, which has already been tried in England and France, a channel 200 feet wide can be kept in the Mississippi River to New Orleans, and that it can be extended past the jetties into the Gulf, insuring the passage there of the largest ocean steamers.

Mr. Adams is a practical civil engineer, and his invention is the result of years of study while engaged in the duties of his profession.

The latest source of natural heat which it is proposed to "tap" for mechanical purposes is the interior of the earth, and what is a little strange about it is that Japan is the place where they propose to do it. Japan may be a good place to do the mechanical part of the business, but it takes a different civilization to successfully float the stock for such an enterprise.

They are making car-wheels of paper, and even a "stationery" engine has been achieved. *Lowell Courier.*

Jackson, Miss., will soon have four railroads, possibly five.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

Horace B. Miller, Prest.

Jackson Bailey, Vice-Prest.

Lycurgus B. Moore, Treas. and Sec'y.

96 Fulton Street, New York.

Jackson Bailey, Editor. Horace B. Miller, Business Manager.

Lewis F Lyne, F. F. Hemenway. } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 Bouverie Street, (Fleet St.) London, Eng.

Will receive subscriptions for the American Machinist at 16/8 per annum, postage prepaid.

DEALERS SUPPLIED BY

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$4.00 to Foreign Countries, postage prepaid.

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NEW YORK, AUGUST 5, 1882.

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The Machinery Situation.

A few weeks ago the press of orders for machinery and tools was declining, and many of the manufacturers were apprehensive of actual dullness before the opening of full trade in other branches of business. Those who had steadily been refusing orders were many of them willing to re-open correspondence with prospective purchasers, and in some cases extreme prices were moderately shaded to secure a few desirable customers. The past three weeks have shown a decided change in the situation. Purchasers who were awaiting events are becoming anxious, and are hastening to place their orders for fulfillment at the earliest practicable moment. Reports that reach us from different quarters, both East and West, as well as our own observations among the shops, agree that a renewed activity has sprung up this month, which was hardly to have been expected in midsummer. If we look for causes, we can, perhaps, discover nothing more potent in bringing about this accelerated movement than the prospect of bountiful crops, especially of breadstuffs, which are likely to be in good demand abroad. The activity in railroad building and equipment will be greatly strengthened by the now almost certain prospect of good crops; and upon the railroad industry more than any other single business depends the demand for machinery and tools. No more rapid progress in railroad construction could be desired than already exists. All that is needed to sustain and push forward the work on so large a scale is a reasonable assurance that enough transportation business can be obtained to make both new and old lines pay expenses. Profits are usually left to the developments of the future. Several railroad enterprises are undoubtedly in advance of public requirements, but the rapid growth of the country—more rapid than ever before—will in time render some lines valuable that are now unnecessary. Locomotive building has not experienced any such check as was reported in daily papers a few weeks ago, and is not likely to be retarded for months to come.

A Railroad Freight Problem.

A very large part of the community—perhaps more than four-fifths—is conservative. The number of people who desire radical changes affecting everybody, and who are laboring to secure them, is, with rare exceptions, a minority. There have been eras in our history as a nation when this fact, in the light of subsequent events, was to be deplored, yet its continued existence is undoubtedly productive of more public good than public evil. Wrongs may sometimes be endured for long periods, because it has taken years to convince the great body of people that a radical change is needed, and that some proposed change will prove an actual public advantage rather than a questionable experiment. It is apparent to the careful student of public affairs that the large conservative element among the people has not fallen in with the ideas entertained and expressed by the so-called Anti-Monopoly League in regard to railroad restrictions. We do not mean that they reject the specifically-prepared "platform" of the league, for "platforms," as frequently constructed, ingeniously cover up the real object of a movement rather than define it clearly and fully. The proposed plans and methods advocated, rather than the proposed results, are what conservatives hesitate to approve and follow, for results of a great movement are often quite contrary to what has been promised. Some one has truly said that "the people are moved slowly by argument, but rapidly by events." The conservative classes have undoubtedly been of the opinion that evils which do not exist have been charged to the railroads by the enthusiastic partisans of anti-monopoly. On the other hand, events of the last four or five weeks have been of such a character as to convince even those strongly opposed to radical measures that there are evils in railroad management which affect the public to such a degree as to require serious attention. The strike of freight handlers in New York City and vicinity has brought both railroads and shippers of machinery tools and supplies, as well as perishable freight, to grapple with the problem whether the former are obliged, by virtue of special privileges granted them by the State, to receive and forward freight with ordinary expedition wherever they have facilities for doing so.

Merchants and manufacturers who are obliged to depend upon railway transportation have been losing thousands of dollars, day after day, by the neglect or refusal of railroad companies to receive and transport freight without unreasonable delay. Rates of transportation were advanced by these companies thirty to fifty per cent. while refusing to pay a price for the necessary handling of freight that would secure men competent to do it expeditiously, as shippers have a right to expect. The public (who are the sufferers) do not claim any right to decide what the railroads shall pay their employés, but they insist upon being furnished with proper transportation facilities when nothing stands in the way but the disposition of railroad managers not to pay a fair price to men who are willing and able to do the work. Were the demands of all the laborers that could be engaged extravagant and unreasonable, some excuse for their action in blocking trade might be offered; but it can hardly be claimed by the managers themselves that 20 cents an hour, or $2 a day, for work requiring stout, able-bodied men is an extravagant price. Were they able, however, to secure all the men needed to do the handling promptly, at 17 cents, or even 15 cents an hour, the public, while it might sympathize with the condition of the workmen, would not enter a protest against the railroads. In whatever way the case is viewed, it does not exempt the railroad managers from just censure, and the contest is not likely to be terminated with the resumption of proper freight transportation.

A Liberal Southern Town.

The General Manager of the Western Union Telegraph Company has proposed to the citizens of Lexington, Ga, that if they would furnish and put up the posts to Crawford the company would furnish the wire and instruments, and give Lexington telegraph communication with the rest of the world. The citizens hastily accepted the proposition, and in one day enough funds were raised to accomplish the purpose.—*Chattanooga Tradesman.*

If the above item is correct, the citizens of Lexington have exhibited a liberality towards a powerful and growing monopoly hardly ever equaled in this country. With the poles cut, trimmed and set in place, the greater part of the expense of constructing a telegraph line is completed. All that remains is to run a wire or two over the poles and the telegraph is ready for business. The trifling expense of a few instruments, batteries and some chemicals is all that is needed in the way of equipment to operate the line and make it yield a revenue. Some might be surprised that the citizens of Lexington did not devote another day (or part of a day) to the raising of what little additional funds were required to complete the line and equip it, thereby making the telegraph their own, to be used wholly for the convenience and profits of the citizens; but then there are others who might be surprised that the liberally disposed people of Lexington did not furnish the line and present it entire, without conditions, to the Western Union Company.

The advance sheets of the Census of 1880 are worth studying. One of the latest sheets gives the average amount earned per year by the workers for wages (men, women and children) in all manufacturing industries in the twenty leading cities. The highest average is in Washington, $547, and the lowest in Milwaukee, $321. Next to Washington stands San Francisco, $521, and next to the latter, Brooklyn, $466. Many of the workers for wages at the National capital are employed by the Government, which is a liberal employer, while in San Francisco, prices rule higher than in Eastern cities. The inference from the table of the census bulletin seems to be that a greater portion of the wage workers in Brooklyn are skilled artisans than in any other of the twenty cities. In Philadelphia the average is $349, in Newark, $401, and New York, $423, while Chicago rises to $435, and Pittsburgh to $436. Buffalo has the lowest average of any of the three cities of New York State to wit, $416.

Literary Notes.

A TREATISE ON THE CONSTRUCTION AND USE OF UNIVERSAL MILLING MACHINES, as made by Brown & Sharpe Manufacturing Co., Providence, R. I.

Unquestionably the lathe was first used for performing cutting operations by means of rotary cutters mounted and revolved on an arbor between the centers, the time when special jobs were not done in this way dating back beyond the memory of most machinists. From the evident advantages of the rotary cutter, even when used in a machine in no way well adapted to the purpose, grew the constructing of special milling machines, designed for performing one or two particular operations, and finally the universal milling machine, so called from its adaptation to perform such a variety of work in the processes of removing metal in machine and machinery construction. It is altogether unfortunate that so little is known of the utility of this machine as a common machine-shop tool, and any means of spreading information in regard to its construction and use will undoubtedly be welcomed by the operative machinist as well as by the machine-shop proprietor, tending as it will to broaden the views of both with reference to possible machine-shop operations and machine-shop economy.

The object in the preparation of this book was to furnish information regarding the universal milling machine, and some of the operations that may be performed with it, in a clear, comprehensive and thoroughly practical manner, that could at once be understood by the mechanic of ordinary intelligence. To this end, after a short general introduction, there is given a description of the machine, explanatory of the parts, the manner of arranging, adjusting, &c., and the capacity and use, with full information to the novice as to starting and operating.

Further on, the spiral head and its use is explained with numerous examples. The operation of gear cutting, fluting taps and reamers, making cutters of various descriptions, cutting spiral flutes as in twist drills, together with a large variety of work both special and general, are clearly described in the text, as well as illustrated in the plainest manner by engravings, of which the book contains about eighty.

Tables and formulæ for gear cutting, sizing gears, and for special operations are given. The book is printed on extra heavy paper and strongly bound, fitting it for use about the shop by those who may find it to their advantage to use it at times when, for obvious reasons, they cannot handle it with special care. Coming as it does from a concern so competent to treat the subject, it will furnish a welcome addition to current technical literature.

We are not advised of the price, but it will be readily furnished upon application to the Brown & Sharpe M'fg. Co.

ANNUAL REPORT OF THE SECRETARY OF INTERNAL AFFAIRS OF THE COMMONWEALTH OF PENNSYLVANIA. Part third, Industrial Statistics, Vol. IX., 1880-81.

We are indebted to M. S. Humphreys, Commissioner of Statistics, for a bound copy of the above report. It is a book of 642 pages, containing valuable information in reference to the principal industries of the State, including coal mining, iron and steel production, textile fabrics, machine shop and foundry products, &c., &c., illustrated with maps of the coal producing districts. The work contains in addition to this, special labor laws of the State, together with a very full account of labor troubles, the United States Census by towns and counties, the number of workmen engaged in the different industrial enterprises, and much other miscellaneous information.

Personal.

Mr. John H. Harris, for some years manager of the New York branch of the Deane Steam Pump Works, severed his connection with that establishment July 15th, and has accepted a position with the Worthington Hydraulic Works, 239 Broadway, New York. Mr. Harris is a veteran in the steam pump business and has a large circle of friends.

Mr. Eberhardt, of Gould & Eberhardt, Newark, N. J., has started upon a trip to Switzerland, the land of his boyhood, after an absence of thirty-three years. As he said to us, he "will take a look at the progress of tools on the Continent." We hope to favor our readers with some of the results of his observations upon his return.

Mr. Harris Tabor, inventor of the Tabor Steam Engine Indicator, has resigned his position as Superintendent of the works of the Hartford Engineering Company and will probably locate in Pittsburgh, Pa.

We recently received a call from A. J. Shaw, M. E., who has just withdrawn from the firm of Gross, Shaw & Co., machine tool builders, of Auburn, Me.

Among the machinery men now traveling in Europe are Mr. Alexander Gordon, Manager of the Niles Tool Works, and Mr. Henry R. Towne, President of the Yale Lock Manufacturing Company.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(263) S. B., Los Angelos, Cal., asks: Which side of a leather belt should be run next to the pulley? *A.* There is some difference of opinion on this subject, but the balance of opinion is largely in favor of using the hair, or smooth side, next the pulley.

(264) F. C., Hopewell, Pa., asks: How is a butterfly valve made? *A.* A butterfly valve is made of two parts hinged in such a way as to have some resemblance to the wings of a butterfly. 2. How shall I set a gear cutter to cut a gear wheel that is used to shift the carriage of a lathe on the lead screw, the pitch being ¼"? *A.* See article on worm gearing in the AMERICAN MACHINIST of Feb. 7, 1880.

(265) M. L., Corpus Christi, Texas, asks: 1. Will you tell me the simplest way to figure the power of a rotary engine? *A.* Precisely as you would calculate the power of any steam engine; that is: multiply the area of piston by the effective pressure and by the speed in feet per minute, and divide the product by 33,000. Of course you must get the *mean* speed of piston. 2. Is a rotary engine adapted for running small machine tools? *A.* Not if you have much regard for the size of boiler required or the amount of fuel burned. 3. What would be the dimensions of a 4-horse rotary engine with steam pressure 60 pounds? *A.* This cannot be told without knowing the construction of the engine. Rotary engines have not as yet assumed any definite form, and cannot be rated and spoken of the same as the reciprocating steam engine.

(266) J. S., Brooklyn, N.Y., writes: I am about to erect a superheater which I propose to make so as to put it up in the back connection of a horizontal boiler set in brick work. I intend to make it of 1" pipe with 1" connection to boiler and lead from the heater by ½" pipe about 100 feet. I need a heat of about 350 degrees. The steam pressure on boiler will be 60 pounds. The heater is about 2½ feet long, giving me 10 feet of pipe for the steam to pass through. Will I be able to get the desired heat, and will I have to put a check valve between heater and boiler? *A.* You will not be able to get any such heat as you speak of, that is, if you use any considerable amount of steam. We have never seen a check valve used for the purpose you propose, although we have heard the propriety of so using one discussed. If you were able to get the required heat it would be difficult to control it, and it might become dangerous, especially if you used the check valve. There has been, to the best of our knowledge, no satisfactory superheater devised, the best perhaps being a separate boiler with upright tubes in which the fire is some distance from the heating surface. In this the steam is superheated and then mixed with steam direct from an ordinary boiler, the flow being regulated by means of a valve so as to maintain the desired degree of superheat. The definite superheating and the use of superheated steam is a very difficult matter to deal with, and unless you have had some practice it would be better for you to secure the services of some one who had, to assist in completing your arrangements.

(267) J. R., Detroit, Mich., asks: 1. Will you tell me how by lessening the throw of a valve by cutting up with the ordinary link, the lead is increased? I would naturally think the reverse would be true, since in that case the valve would have further to travel. *A.* The link motion is substantially equivalent to a movable eccentric. If you had an eccentric that you could readily move on the shaft in any direction, you can see that you could vary the lead as you desired. The arrangements by which the link operates, and by which it is moved, are such that when used in its more common form the operation of shortening the travel for earlier cut-off slightly increases the lead, but exacely how it does this we cannot explain without the use of diagrams. Read some work on the link motion, and you will be able to comprehend it. 2. How does the governor of a Buckeye engine operate to vary the cut-off to suit the load? *A.* By turning the eccentric on the shaft. 3. What is the best way to take up the lost motion in a ball and socket connection? *A.* File or otherwise reduce the two parts of the box at the joint, so as to let them a little closer together. 4. Is there any particular way of telling when an engine pounds in the connecting rod? *A.* An expert engineer sometimes tells by the sound, sometimes by putting his hand on the rod and feeling the jar, and in other ways. It is entirely a matter of education. 5. Will a pin out of truth by wearing more on one side than on the other cause an engine to pound? *A.* Yes. 6. How is it a vacuum pot helps the closing of a valve? *A.* By removing the pressure of the atmosphere from one side of the dash-pot piston. 7. How is the vacuum maintained? *A.* Usually by a connection to the condenser. 8. In the balance valve described in the AMERICAN MACHINIST in connection with the Allen valve, how is the pressure relieved? *A.* See description of this valve in our issue of July 16, 1881. 9. Will you tell me how a rotary valve can be run with gears? *A.* By gearing from the crank shaft.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

For model engine castings, address Wm. Rich, 231 Vine Street, Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

"Steam Economy," 124 pp., cloth, $1.00 illustrated), points out remedies for defects in engines. Best indicator practice. A. Wilkinson, 123 n. 4th St. Phila.

Mechanical Engineering.—To learn inventing, designing and construction of machinery at school. Address, S. W. Robinson, Ohio State University, Columbus, O.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Jas. F. Hotchkiss, 81 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

"Slide Valve Gears," by Hugo Bilgram, published by E. Claxton & Co., Phila., describes the easiest method known for correctly proportioning slide valves, link-motions and cut off gears; price, $1.00.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

For Sale. Price, $7.00. "The Mechanician," by Cameron Knight, a treatise on the construction and manipulation of tools for the use and instruction of young engineers and scientific amateurs. 1,147 engravings. Address, Box 1, Care AMERICAN MACHINIST.

If you desire to keep pace with the daily progress and development of Telephone, Telegraph and Electrical matters, have a copy of the NEW YORK REVIEW OF THE TELEGRAPH AND TELEPHONE sent to your address. Only $2.00 per annum. George Worthington, Editor and Proprietor, No. 23 Park Row, New York. P. O. Box 3329.

"Sibley College of Mechanic Arts, Cornell University.—Entrance examinations will be held June 12th and September 11th, 1882. For the register and catalogue just issued, containing reorganized courses of instruction, scientific and practical, including draughting, machine construction, general shop work, etc., apply to the President of Cornell University, Ithaca, N. Y."

The Student's Illustrated Guide to Practical Draughting. Price, $1.00. Lectures in a Workshop, with an appendix containing famous papers by Sir Joseph Whitworth, on "Plane Metallic Surfaces," "Uniform System of Screw Threads," etc. Price, $1.00. Either work sent on receipt of price on application to the author, T. P. Pemberton, 142 Greenwich street, (P.O. box 3083), New York.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a wise and witty way that will be instructive to old and young mechanics, and interesting to everybody. As many as 150 copies have been sold in a single shop. Over 40 humorous illustrations; 320 pages, 12 mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton St., New York.

To Machinists Pattern-Makers and Millwrights—I have compiled the most complete table of the diameters of Pitch Line of Toothed Wheels ever published. This table supplies a long-felt want, as the numerous testimonials I am receiving will attest. The table is very complete in every particular, and from it you will get a result at a glance without calculating. No algebraic terms are used; it gives the pitch line of toothed wheels from ½ to 4 inches pitch, and from 12 to 100 teeth. Third edition now on the press. Orders promptly filled. Price, $2.00. Address, Wm. T. Ross, First and Washington streets, Louisville, Ky.

MANUFACTURES.

The shops of the Southern Pacific Railway are to be located at Houston, Texas.

The United States Rolling Stock Co. propose to establish large shops at Cummings, near Chicago.

The National Tube Works, of McKeesport, Pa., have suspended operations on account of a scarcity of iron.

Arrangements have been made to erect a spike manufactory at Fostoria, Ohio, to be known as the Fostoria Spike Works.

Negro citizens of Nashville, Tenn., have organized a cotton manufacturing company, and will commence operations as soon as a suitable site can be obtained.

Jamestown, N. Y., people have contributed over $40,000 in the past ten years toward establishing manufactories, a large increase of population resulting therefrom.

H. C. Pease & Co., Worcester, Mass., have had a proposition from a Philadelphia machinery establishment to take all the iron planers they can build, two to four a month.

J. A. Wilde, Brooklyn, N. Y., has sold a shop right for his patent expanding mandrel to R. Hoe & Co. This mandrel has been very favorably received by machinists.

The Lanphear Machine Co., Phenix, R. I., report a good business and have just increased their facilities by building a foundry, 150x40 feet, which is a model establishment.

Orders for machine tools in Worcester, Mass., have increased very largely within two weeks, and the manufacturers have no more time to go a fishing than they had last summer.

The Transmitting Dynamometer Company, 71 Astor House, New York, write us they are making many sales of their dynamometer, which has, we are informed, been materially improved.

The Athol Machine Company, of Athol, Mass., is preparing to build its new brick foundry, which will be 90x45 feet, with an L 60x25 feet, and contain annealing, pickling, tumbling and grinding rooms.

Schleicher, Schumm & Co., manufacturers of the Otto Gas Engine, have placed orders during the past fortnight for 21 machine tools, to be added to the plant now in use in their new works at 33d and Walnut streets, Philadelphia.

Joseph B. Read, manufacturer of machine tools, Cairo, Illinois, has recently enlarged his foundry and machine shop, placing in some ten thousand dollars' worth of new machinery. He now employs 25 men and reports a fair business.

Cook & Chick, machinists, have recently established their business at 260 and 262 Michigan street, Chicago. They make steam pumps a specialty, and have recently put in new machinery, which increases their capacity very materially.—*Industrial World.*

The necessary amount of capital required by the Co-operative Stove Foundry Association, at Spring City, to succeed the Keely Works, has been subscribed, and operations will be begun as soon as the machinery and patterns owned by the Columbia Company are removed.

The eastern office of the Niles Tool works, 22 South Sixth street, Philadelphia, report a large and rapidly growing demand for their double axle lathes, boring mills, and other specialties, especially from railroad shops. They note a large increase in inquiries since July 1st.

Clem & Morse, 413 Cherry street, Philadelphia, have all they can do to keep up with orders for their elevators and hoisting machinery. Owners of office and other buildings are finding out that the American public does not climb stairs as willingly as it used to do, and the demand for elevating facilities grows steadily.

Among those setting boilers with the Jarvis Furnace are Eagle Flour Mills, Hannibal, Mo., two flue boilers; Hallett, Davis & Co., Boston, one Babcock & Wilcox boiler to burn screenings and soft coal; The Maryland Pavement Co., Baltimore, two boilers; Madison (Wis.) Water Works, three boilers to burn slack coal.

The Calumet Tool Company's works, at South Chicago, are being remodeled, and a new finishing room has been added. This company have taken up the manufacture of vises in connection with the making of tools, and are placing in new machinery. Thirty-five men are now employed by them, and it is expected that the entire works will be in running order by the 1st of August.

The Bartlett Iron and Steel Works, with a capital stock of $500,000, have decided to go to Vermillion, O., and have secured a site containing about sixty acres of land. The building when completed will be 60x1300 feet, and the company will give employment to several hundred men when in full operation.

The Michigan Tool Works started business at Grand Rapids, Mich., a little more than a year ago, with seven hands, and now employ forty, with business steadily increasing. They build lathes, drills, chucks and other machine tools, as well as do work of a general character. Their works include a general jobbing brass and iron foundry.

During the month of June twenty-two carloads of cotton machinery were shipped from Boston to points in the South over the Richmond and Danville Railroad. The Boston machine shops have notified the Southern transportation lines that they are now working to fill orders for the hundred carloads of machinery, all of which is to be delivered at the mills in the South in early fall.

N. W. Bancroft & Son, Worcester, Mass., have taken a shop 130x40 feet in the old Allen fire-arms building near the Junction. They intend to be moved and have their machinery in place by the first of August. They have castings made for a new iron planer which is to be extra heavy. As yet they have taken no orders for the planer (although asked to do so) preferring to wait until they can assure customers the time of delivery.

J. A. Fuller & Co., Worcester, Mass., are making some improvements in their 18-inch lathes. The head stock has been changed and a new bed designed. The tool post is made to adjust into any desired position and the slide rest is kept in place by both weight and gib. The motion for screw cutting is reversed by means of a lever on the head stock. They have sold several of their lathes (from 6 feet to 13½ feet beds) within the last few months, and are now well supplied with orders.

One of the leading enterprises at Richmond, Va., is the Tanner and Delaney Engine Company's new works being erected on the flat, north end of Fifth Street. The building will cover several acres, and will be unequaled here for convenience of workmen and for the reception of material and delivery of work. A track of the Chesapeake & Ohio railway runs through the grounds, ready to bring in coal and iron and carry off engines and machinery. It will be several months yet before the company can occupy these new works, however. They will employ hundreds of workmen.—*Railway Register.*

The machine tool works of A. W. Powell & Co., Worcester, Mass., employ over 40 men. They are getting out a new rack cutting machine for their own use which will cut racks of any length and up to 12 inches wide. It will work automatically. They have patterns for a new lathe 24-inch gap and 48-inch swing and one 72-inch gap and 36-inch swing. They have orders for several of their new iron planers. We noticed in their shop a lathe with a bed 26 feet long, cast in one piece and neatly finished. They will soon have another 30 feet long in one piece. Their 26 inch lathe with 10-foot bed weighs 5,500 pounds and is believed to be the heaviest lathe of the dimensions made in the country.

Three railroad companies of Virginia have established a Bureau of Immigration and Mining Intelligence at Wytheville, Wythe County, to aid in developing the resources of the State. Joseph B. Austin is manager, and a *Bulletin* is issued for the information of those who apply for it.

At Roanoke, we learn, "The two railway companies are making extensive improvements, it being intended to make this the central point in the administration of the combined system. Large roundhouses and machine shops are in the course of construction; and still more will be added as rapidly as possible; as here will be built and repaired all the engines, cars and equipment of this extended railway combination." Fifteen hundred mechanics will be employed in these shops.

The Crozier Iron and Steel Company is erecting a furnace to make 100 tons of iron a day, and another company has been formed to erect another furnace of the same capacity, but the stock of the latter is not yet taken. An iron bridge building company is also in course of organization.

Crocker & Pell, Minneapolis, Minn., write us: Here in Minneapolis things are moving on. The mills are quiet for want of wheat, but the crop prospects are inspiring people and the tone of public feeling is on the rise. The building of houses continues unabated, and some very heavy business blocks are in course of construction, but the high price of building material interferes somewhat. All the iron-working establishments are busy. The North Star, Pray Manufacturing Co., the Union Iron Wooks, Variety Works and the Standard Works all being occupied with work for flour and saw mills with some engine work. We are so much occupied in our own affairs that we have but little opportunity to see what is going on about us. We have just got our large lathe running. It swings 9 feet 10 inches over the V's and can take any work to be done. We are very busy on paper, saw and flour mill machinery and have six electric light machines nearly completed for the Safety Electric Light Co., of this place. We are already forced to extend our machine shop 65x25 feet, also to build sheds to cover core oven and cleaning castings, 50x16 feet. We have secured some patent saw-mill machinery to make, and aim to make the manufacture of fine work of that class a leading specialty. We have just associated Mr. W. A. Goodrich, M. E., with us. He is now perfecting the plans for Corliss and high speed engines, and we propose doing expert work for which there seems to be a field here.

Machinists' and Engineers' Supplies.

New York, July 20, 1882.

Prices of machine tools are well sustained, orders to makers having materially increased within the past fortnight.

General supplies are without material change.

R. W. Rexford, 11 N. 6th street, Philadelphia, announces that he has taken the agency for Naylor's Compressed Steel Shafting, for which important advantages are claimed.

American Pig Iron is slightly advanced in price, No. 1 X quoted at $25.50 to $26.50, on an improving demand. No. 2, X, $23.50 to $24.50. Better grades of Scotch Pig slightly advanced and market strong. We quote Coltness $27 to $27.50; Glengarnock $24 50 to $25. Other metals: Antimony advanced ¼c to ⅛c: Cookson quoted 13c to 13½c: Hallett's 11½c to 11¾c. Copper unchanged, demand light. Tin, substantially unchanged. Spelter, dull at 5½c for common; refined, 8c to 8¾c. Lead, quiet but firm at 5¼c for refined, 5 1-10c for common.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted.—A first-class Moulder, who wishes a permanent job. Apply at once, or address W. B. & Sons, care American Machinist Office.

Wanted—Situation as foreman of machine shop. Thirteen years experience in Western States. J.E. McConnell, Iowa City, Iowa.

Wanted—Engagement by a competent draughtsman and machinist. A1 references. Address, Franklyn, Box 2, American Machinist.

Two or three first-class journeymen machine pattern makers can find steady employment with Poole & Hunt, Baltimore, Md. Location pleasant and healthful.

To Capitalists.—A leading Draughtsman and Superintendent wishes to meet with suitable opening. Could introduce new lines of business if required; accustomed to Engines, Steam Cranes, Tools, &c. Address Philada, care American Machinist.

Machinist Wanted.—A first-class general workman, steady and reliable, as a leading man on general work can find a steady and profitable situation by addressing, stating experience, reference, and habits, Box 3, American Machinist.

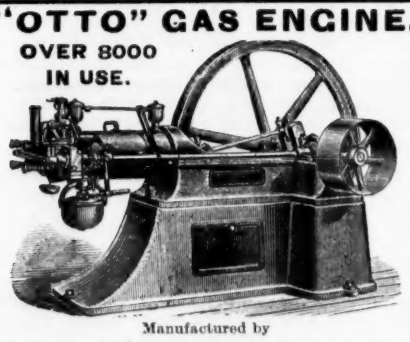
A mechanical engineer, at present manager in a machine tool manufacturing business, will soon be at liberty and desires a position. Is well up in stationary engine, tool and general designing and construction. Address A. J., Box G, Auburn, Me.

Wanted.—Situation as foreman moulder by a first-class practical moulder. Many years experience at the business; accustomed to all kinds of light and heavy work, core making, melting and the construction of patterns. Highest references. Address, H. F., Office American Machinist.

BRADLEY'S CUSHIONED HELVE HAMMER

STANDS TO-DAY
Without an Equal.
OVER 700 IN USE.
Bradley & Co.
SYRACUSE, N. Y.

"OTTO" GAS ENGINE.
OVER 8000 IN USE.



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New England Manufacturers' and Mechanics' Institute
Will be held in THEIR MAMMOTH EXHIBITION BUILDING, (the Largest in the United States),
In Boston during the months of September & October, 1882.

Affording the best opportunity for advertising, or of introducing to the public new inventions. Artists, Inventors, Producers, Mechanics and Manufacturers, from every nation, invited to contribute. The product of New England's hand and brain will be well represented. No charge for space. Blank forms for application to exhibit furnished free, upon application to
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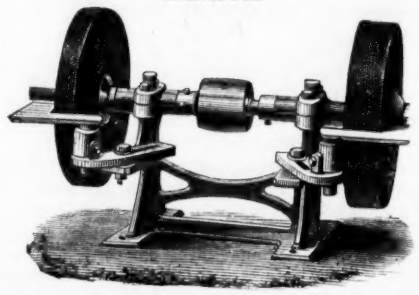

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Our wheels possess superior cutting qualities, combined with great durability. Eureka Plow Polisher and Patent Stove Plate Grinders.

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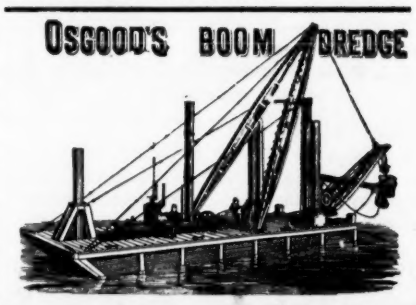

Guaranteed to excavate 50% more material from hard bottom than any other machine. Circulars, comparative strain sheets, &c., furnished.
OSGOOD & MACNAUGHTON, Albany, N. Y., successors to Ralph R. Osgood, Troy, N. Y.

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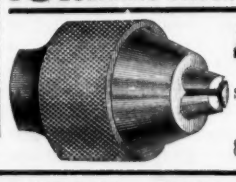
THE STANDARD
MANUFACTURED OF BEST STEAM METAL.
JENKINS BROS. 71 JOHN ST. N.Y.



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Sold at all Machinists' Supply Stores.
T. R. ALMOND,
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Send for New Illustrated Catalogue.
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The Deane Steam Pump Co.
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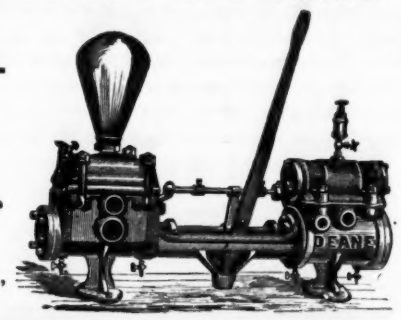
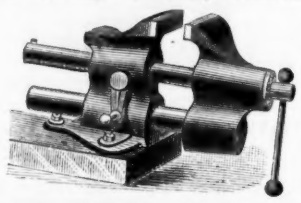
92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.



New Quick-Adjusting, Screw-Clamp, Parallel Bench Vise.
Parts interchangeable. Steel Shafts, Screw and handle.



A strictly first-class machine tool. Compact, rigid, strong, convenient
Address, JOHN THOMSON, 9 Spruce St., N. Y. City

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Manufacturer of
LATHES, PLANERS
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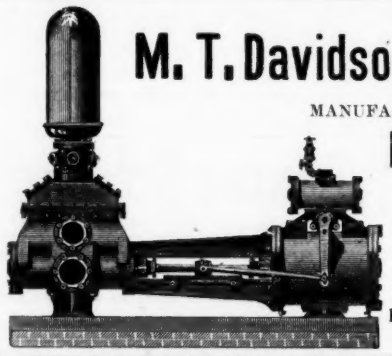

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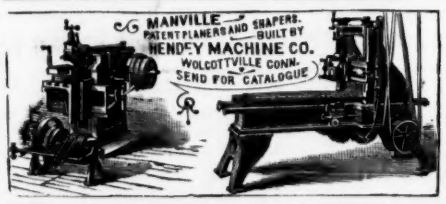

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Manville Patent Iron Planers and Shapers.
15 in. Shapers, 24 in. Shapers, 3½ ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 8 ft. x 24 in. Planers, Amateurs' Hand Planers, with chuck and centers, Hollow Steel Spindle Hand Lathes, Brass and Wire Slitters, Spring Chuck, and Common Clock Lathes. Catalogue gives many names of users of our tools.

FRANK THOMPSON,
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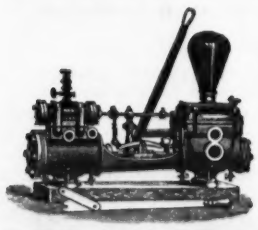

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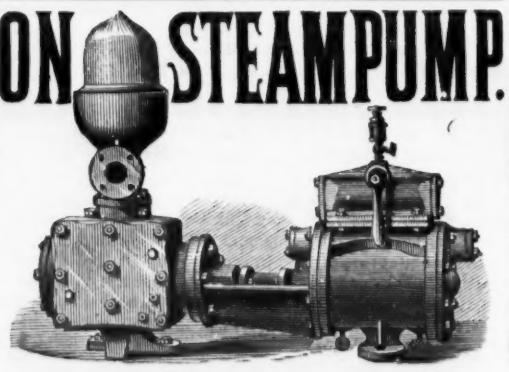

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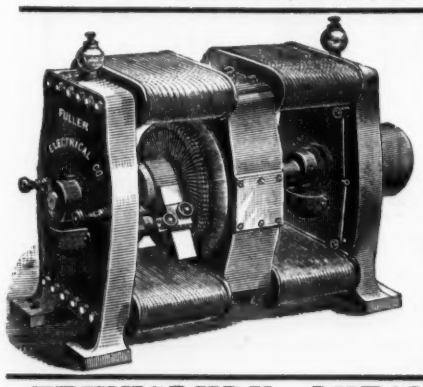

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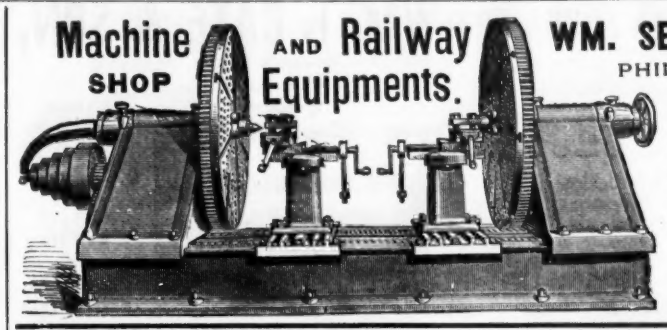

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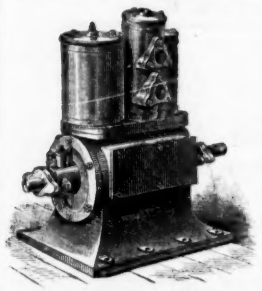

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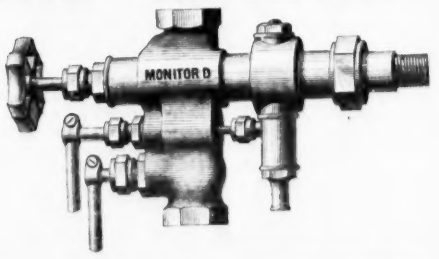

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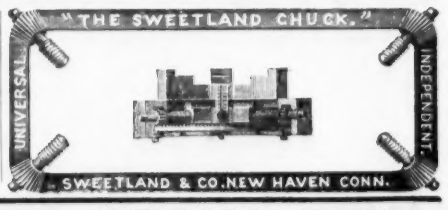

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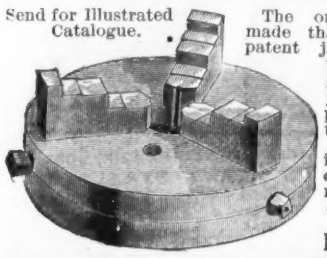

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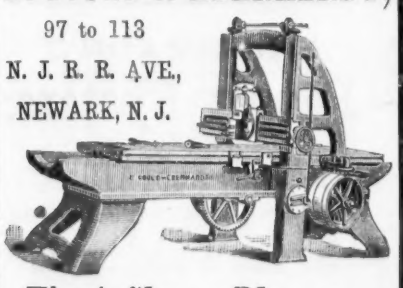

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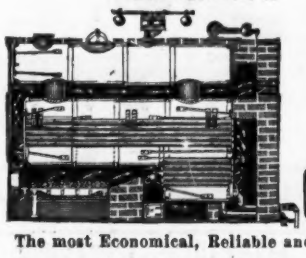

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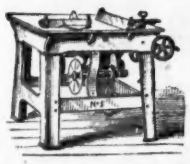

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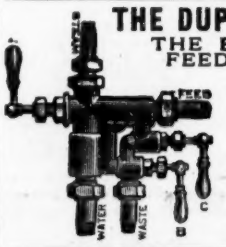

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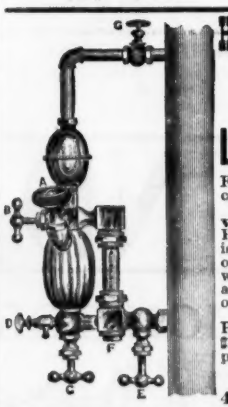

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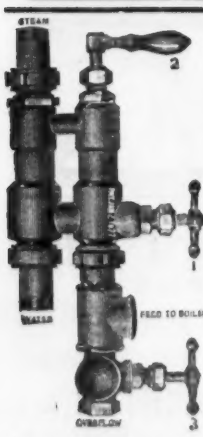

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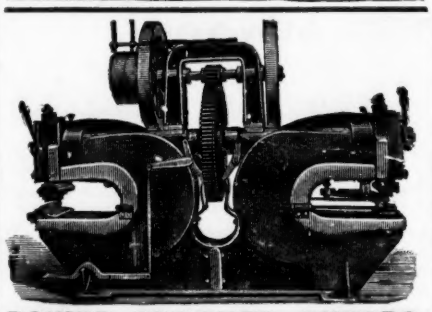

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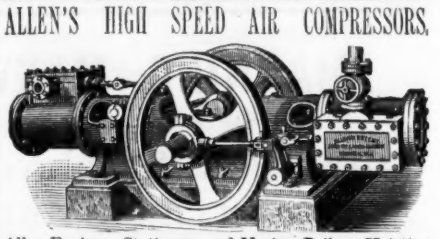

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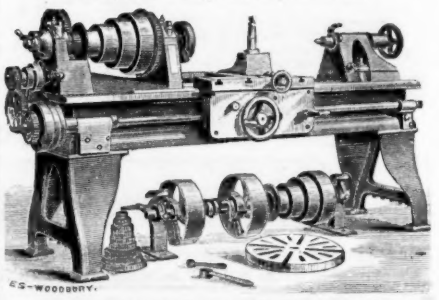

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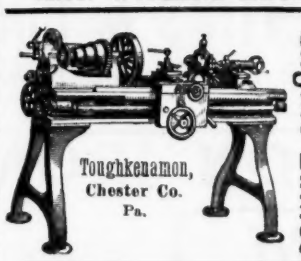

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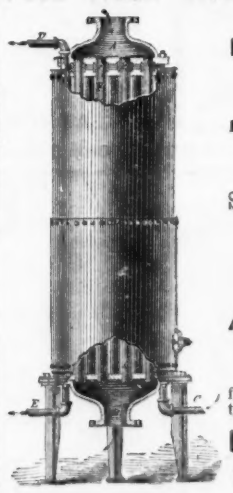

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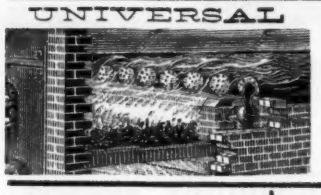

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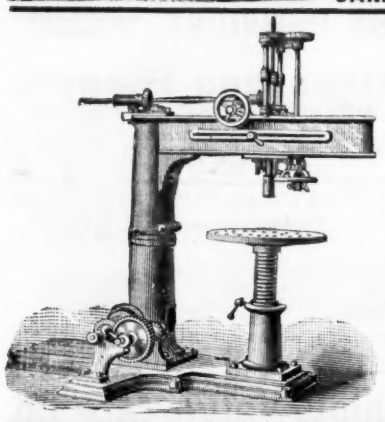

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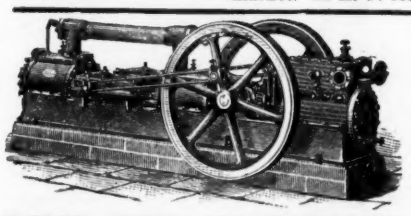

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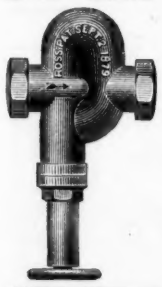

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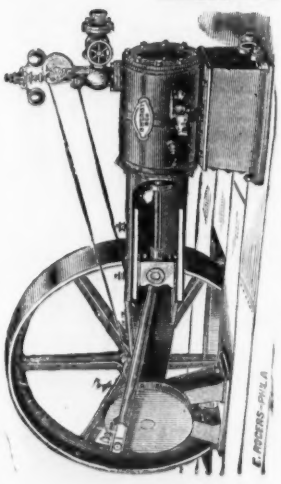

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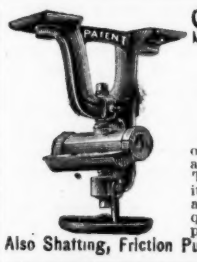

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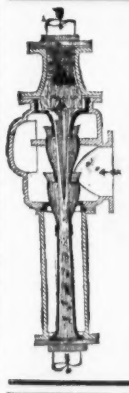

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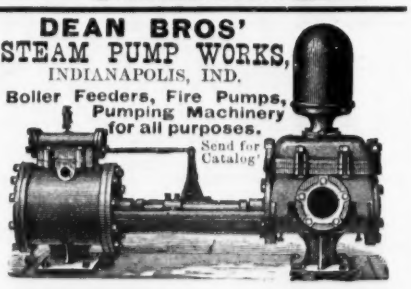

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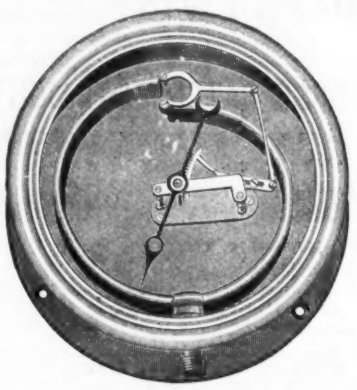

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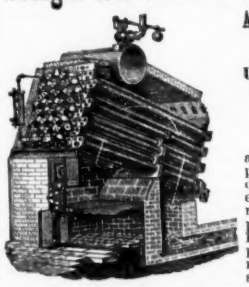

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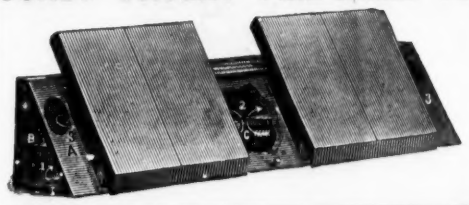

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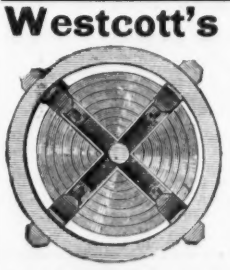

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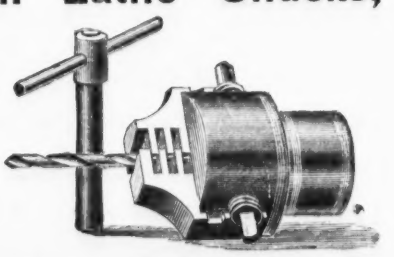

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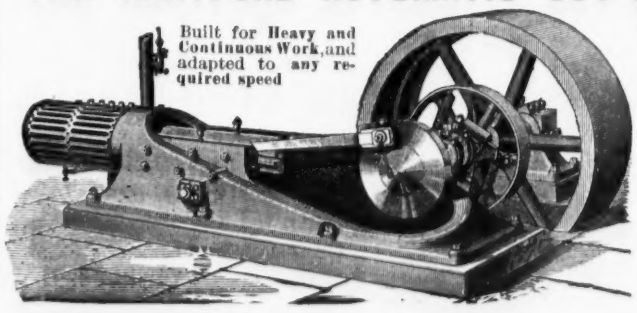

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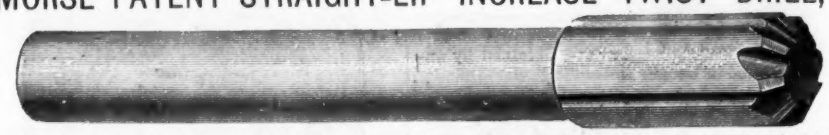

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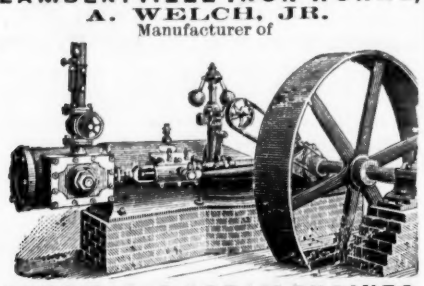

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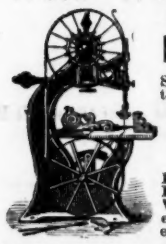

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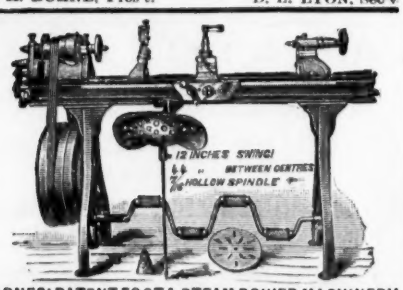

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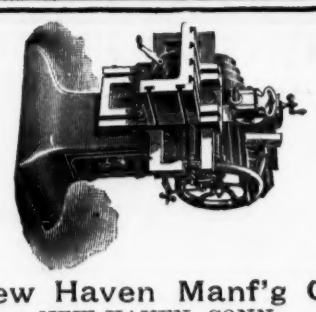

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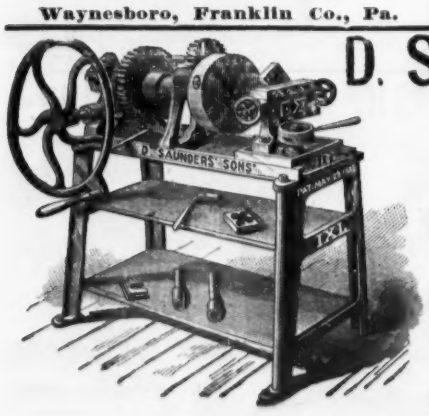

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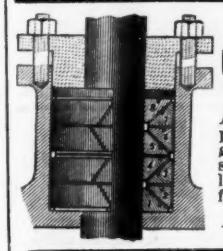

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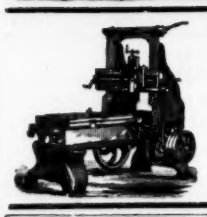

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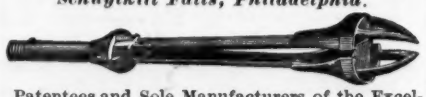

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Having formerly been a contractor in building the same, will give first-class work to all who favor me with their orders.

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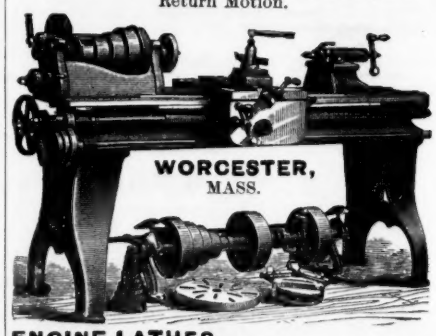

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SLIDE RESTS, and
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HAND & POWER SHAPING MACHINES. Full length of stroke 6 in. May be adjusted to any less distance desired. Automatic cross feed, with 6 in. traverse. Vertical adjustment of table, 5 inches.

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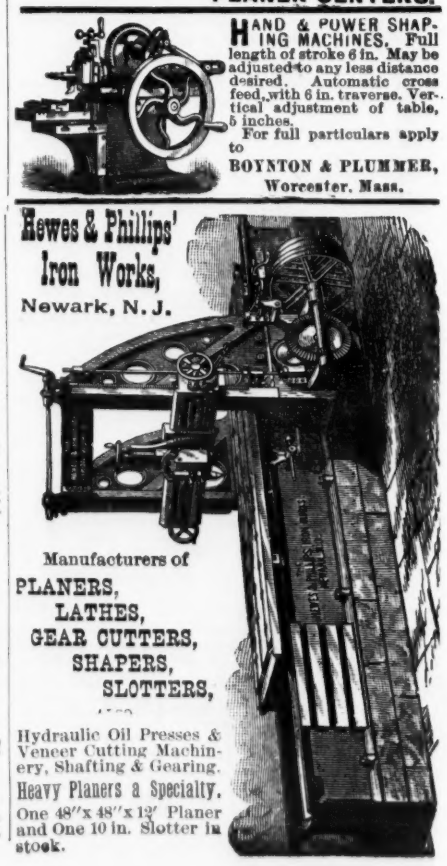

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Heavy Planers a Specialty.

One 48″x 48″x 13′ Planer and One 10 in. Slotter in stock.

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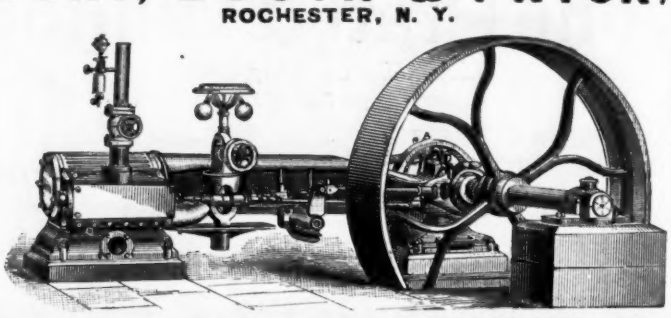

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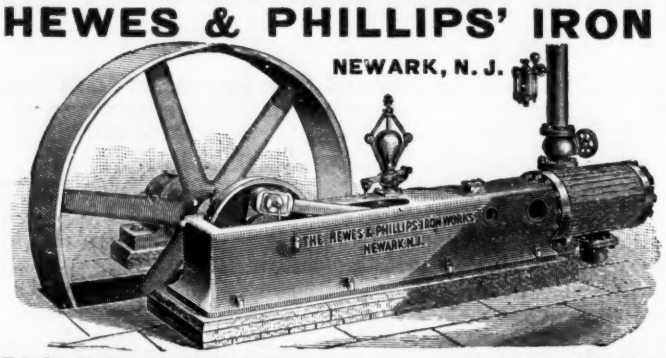

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Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

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NEW IRON WORKING MACHINERY On Hand or for Quick Delivery.

Write for prices and particulars.

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38 inch, triple-geared (bed to suit).		Fitchburg.
28 inch swing,	18 foot bed.	Fitchburg.
26 " "	18 "	Fitchburg.
24 " "	14 and 16 "	Fitchburg.
21 " "	12 and 14 "	Blaisdell.
20 " "	14 "	Fitchburg.
20 " "	12 "	Fifield.
19 " "	10 and 12 "	Gray.
18 " "	10 and 12 "	Blaisdell.
17 " "	6 "	Johnson.
16 " "	6 and 8 "	Fitchburg.
14 " "	6 and 8 "	Fitchburg.
13 " "	8 "	Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
25 inch x 25 inch x 8 foot,	Fitchburg.
30 inch x 30 inch x 10 foot,	Hewes & Phillips
36 inch x 36 inch x 9 ft., planer.	2d hand, good order.
	Wheeler.
26 inch x 24 inch x 6 and 7 ft. planer,	Wheeler.
22 inch x 20 inch x 4 ft. planer,	Wheeler.
10 inch stroke shaper,	Fitchburg.
15 inch stroke crank planer,	Blaisdell.
10 inch stroke shaper,	Gould.
15 inch stroke shaper,	Gould & Eberhardt.

DRILL PRESSES.

60 inch radial drill, double-geared, self-feed, planed and slotted bed-plate with portable table. Best English make. Weight 4 tons.	
48 inch radial drill, self-feed, double gearing slotted and planed bed.	Betts.
30 inch, back-geared, automatic.	Prentice.
25 inch, back-geared, self-feed,	Fitchburg.
25 inch, quick return.	Blaisdell.
19 inch, " "	Blaisdell.
18 inch, " "	Blaisdell & Fitchburg.
2, 3, and 4 spindle drills,	Garvin.
15 inch swing, 5 foot bed, Fox Lathe,	Gage.
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Power and Hand Millers,	Garvin.
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Copies or Tracings of any class of machinery made and used in Europe. 2000 designs. **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, N. Y.

New and Second-Hand Iron Working MACHINERY.

Two Engine Lathes, 42 in. x 16 ft. Triple Geared. Ames. New. August.
One Engine Lathe, 28 in. x 16 ft Ames. New.
One " " 28 in. x 17 ft. Fifield, "
One " " 28 in. x 21 ft. " "
One " " 24 in. x 14 ft. Ames, "
One " " 24 in. x 12 ft. " "
One " " 24 in. x 10 ft. " "
Two Engine Lathes, 24 in. x 12 ft. Fifield. New.
Two " " 24 in. x 10 ft. " "
Three " " 20 in. x 12 ft. Ames. New.
Three " " 20 in. x 10 ft. " "
Three " " 20 in. x 8 ft. " "
One " " 20 in. x 10 ft. Jones&Lamson. New.
Two Engine Lathes, 18 in. x 7 ft. Armsley & Harrington. Good order.
One Engine Lathe, 16 in. x 6-7-8-10-ft. Bridgeport Mch. Tool Works. New.
Six Engine Lathes, 16 in. x 6 ft.-7ft. x 8 ft. Ames. New.
One " " 15 in. x 6 ft. with Turret. Flathers. New.
Two Engine Lathes, 14 in. x 6 ft. Star Tool Co. New
Six " " 13 in. x 6 ft. Ames. New.
Two " " 13 ft. x 5ft. " "
Six Hand Lathes. 12 in. x 5 ft. Hendey. New.
One Crank Planer, 12 in. Belden. New.
One Planer 16 in. x 3 ft. Belden. New.
One " 20 in. x 4 ft. Lathe & Morse. Good order.
One " 24 in. x 6 ft. —— Good order.
Two " 24 in. x 6 ft. Ames. New.
One " 28 in. x 6 ft. Gleason. New.
One " 37 in. x 10 ft. Second-hand. Good order.
One 6 in. Stroke Shaper. Boynton & Plummer.
Two 9 in. Stroke Shapers. Hewes & Phillips.
One 10 in. Stroke Shaper. Pratt & Whitney.
One 15 in. Stroke Shaper. Hendey. New.
One 10 inch Stroke Shaper. Gould & Eberhardt. New.
One 24 in. Stroke Shaper. Hendey. New.
Three Screw Machines. No. 1. Pratt & Whitney. Good order
One Screw Machine. Secor. No. 2. Wire Feed.
One Screw Machine. No. 3. Plain. Pratt & Whitney. Good order.
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Three 4 Spindle Drills. No. 2. Pratt & Whitney.
One 4 " " Garvin. Good order.
One 3 " " " New.
One 6 " " No. 1. " "
Two 20 in. Upright Drills. Prentiss. New.
One 24 in. Upright Drill. Prentiss. New.
One 30 in. Upright Drill. Prentiss. New.
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14 Lincoln Millers and Vises. Good order.
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One No. 1 Miller Power, " " "
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One 10 lb. Air Hammer. Hotchkiss. Good order,
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All sizes Bradley Hammers furnished to order promptly

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New and Second-hand Machinery.

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1 Engine Lathe, 14 in. x 6 ft. Grant & Bogert. New.
1 " " 42 in. x 14 ft. New.
1 " " 21 in. x 6 ft. In good order. Pond.
1 " " 18 in. x 8 ft. " " "
1 " " 14 in. x 6 ft. Star Tool Co. New.
1 " " 15 in. x 6 ft. "
1 " " 16 in. x 6, 7 & 8 ft. Bridgeport. "
1 " " 13 in. x 5 ft & 6 ft. Ames. "
1 " " 16 in. x6, 7 & 8 ft. Ames. "
1 " " 18 in. x8 & 10 ft. Lodge & Barker "
1 " " 24 in. x 12 ft. Perkins. "
1 " " 22 in. x 18 ft. " "
1 " " 30 in. x 16 ft. " "
1 " " 22 in. x 10 ft. Fifield. New.
1 " " 11 in. x 4 ft. & 5 ft. Prentiss.
1 " " 11 in. x 4 ft. New.
1 " " 12 in. x 5 ft. Young. New.
1 Plain Engine Lathe, 16 in. x 4 ft. "
1 Engine Lathe, 15 in. x 4 ft. Plain. New.
1 Fox Lathe, 25 in. x 5 ft. Pike & Dean. "
1 15 in. x 4 ft. Turret Lathe. Lodge & Barker.
1 Planer. 28 in. x 28 in. x 6 ft. A1 order
1 " 36 in. x 36 in. x 10 ft. Good order. Wheeler
1 " 36 in. x 36 in. x 6 ft. " " Harrington
1 " 16 in. x 16 in. x 3 ft. new
1 " 24 in. x 24 in. x 6 ft. "
1 " 26 in. x 26 in. x 7 ft. "
1 Upright Drill, 16 in. Prentiss. "
1 20 in. Upright Drill. " "
1 23 in. " " B. G. S. F. Thompson. New.
1 24 in. " " Prentiss. New.
1 30 in. " " " "
1 20 in. Shaper. Gould & Eberhart. "
1 15 in. Shaper. Hendey. "
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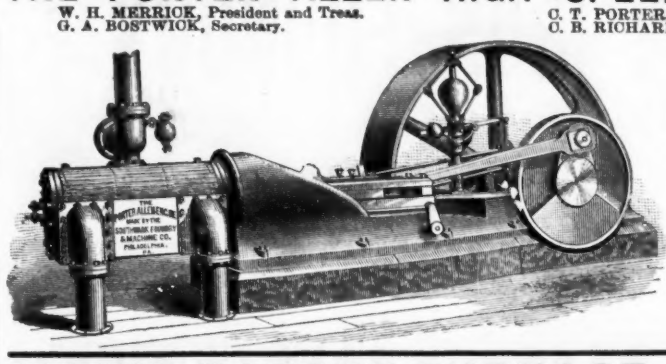

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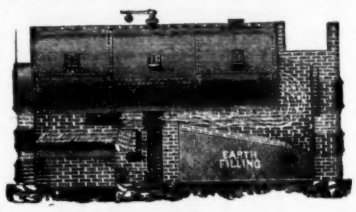

Economy of Fuel, with increased capacity of steam power.
The same principle as the SIEMANS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire.
Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c.

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UTILIZES A POWER HERETOFORE THROWN AWAY.

Works automatically at a steam pressure of less than half a pound. Adapted to all pressures.

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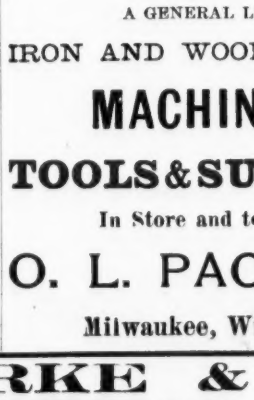

NEW & SECOND-HAND MACHINERY.

July 10, 1882.

1 Engine Lathe, 14 in. swing x 6 ft. bed. Ashton Hand. New.
1 Engine Lathe, 11 in. swing x 5 ft. bed. New.
1 " " 11 in. " x 4 ft. " Prentice. New.
6 " " 11 in. " x 3 ft. 6 in. bed. New.
1 Back Geared Foot Lathe, 9 in. swing x 4 ft. bed, with Slide Rest and 2 Chucks, mounted on wooden bench. Second-hand. Good order.
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Brigg's Foot Lathes. Nos. 1 and 2. New.
Polishing " Small and Large. New.
1 Upright Drill, 2 Spindles. Garvin. "
1 Sensitive Drill. "
3 Light Drilling Machines. "
A full assortment of Lathe Attachments, Countershafts, Chucks, Drills, &c., &c.

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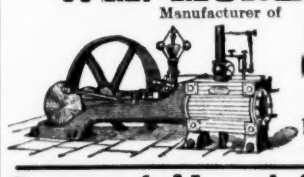

IMPROVED CORLISS ENGINE.

1st Av. cor. 30th St. New York.

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The following New and Improved Machinists Tools are part of what we have for early delivery

1 42 in. Swing, 16 ft. bed. New Engine Lathe. Aug. 1
1 42 in. " 20 ft. " " " " "
1 36 in. " 12 ft. " " " " "
1 22 in. swing, 18 1/2 ft. Bed Engine Lathes. June.
1 26 in. swing, 14 ft. bed. Aug. 1st.
1 26 in. " 16 ft. " " " New.
2 26 in. x 7 ft. Planers. New. Aug. 1st.
1 32 in. x 8 ft. " " Sept. 1st.
1 38 in. x 10 ft. " " Aug.
1 38 in. x 12 ft. " " "

The following on hand.

1 30 in. swing, 18 ft. Bed Engine Lathes. New.
1 22 in. " 11 1/2 ft. " " "
2 22 in. " 12 ft. " " "
4 19 in. " 8 ft. " " "
1 19 in. " 10 ft. bed. "
2 18 in. " 8 ft. " " "
1 18 in. " 11 ft. " " Tilting carriage.
5 15 in. " 6 ft. " " New.
1 Square Arbor Fox Lathe. New.
1 15 in. swing, 9 ft. Hand Lathe. New.
3 12 in. " 6 ft. " " "
1 10 in. " 4 1/2 ft. Bed Hand Lathe. New.
2 30 in. x 8 ft. Planers. New.
1 26 in. x 26 in. x 6 ft. Planer. New.
1 22 in x 4 ft. Planer. New.
2 38 in. Swing Upright Drills. B. G. & S. F. New.
1 26 in. Drill. B.G.&S.F. New.
1 18 in. Bench Drill.
1 2 Spindle Drill. New.
1 4 " " "
1 3 " " Second-Hand.
2 4 " " "
2 Wall Drills, heavy. Second-hand. 60 in
2 12 in. Shapers. New.
2 15 in. " "
1 Pratt & Whitney Hand Miller.
1 Sellers Milling Machine. 2d-hand.
1 Face Milling Machine. Second-hand.
1 Pond's Double Milling Machine. 2d-hand.
1 No. 2 Screw Machine. Wire Feed. New.
1 No. 1 " Brown & Sharpe. 2d-hand
1 Screw Head Slotter. Second-hand.
3 Second-hand Profiling Machines
2 4 1/2 in Hyde's Patent Centering Machines. New.
1 Emery Grinder, 2d-hand, for 10 in. Wheels.
1 Pipe Cutting Machine. Second Hand. 2 in.
1 Bolt Pointing Machine. Second-hand.
1 Double Nut Tapper. New Horizontal.
1 Horizontal Boring Machine, 10 in. Swing. 2d-hand.
1 Betts, No. 2, Power Punch. New.
4 Double-Acting Presses, No. 3, nearly new.
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2 Small " " Presses, "
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Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.
Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in store.

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IRON WORKING MACHINERY.

Complete List of Tools for Quick Delivery Furnished on Application.

PARTIAL LIST OF TOOLS ON HAND,

40 inch swing, 12 foot bed, Triple Geared Gleason Engine Lathe.
28 " " 26 " " Ames Shafting Lathe.
26 " " 25 " " Powell Shafting Lathe.
26 " " 20 " " " Engine "

Iron Planers.

27 in. x 24 in. x 6 ft. Pond Second-hand.
24 in. x 24 in. x 6 ft. Hendey Machine Co.
22 in. x 20 in. x 5 ft. Wheeler.
30 in. x 30 in. x 10 ft. Whitcomb Mfg. Co. Planer.
27 in. x 24 in. x 6 ft. Pond Planer. Second-hand, in good condition.

SEND FOR ILLUSTRATED CATALOGUE OF MACHINE TOOLS.

NEW IRON FOUNDRY.

Having completed a Foundry of a capacity beyond our own wants, we are prepared to furnish promptly

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ANNEALING DONE TO ORDER.

Your patronage is respectfully solicited

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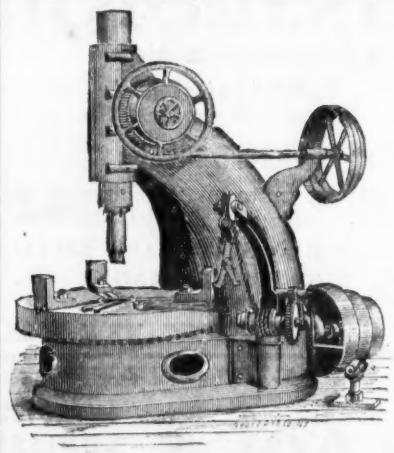

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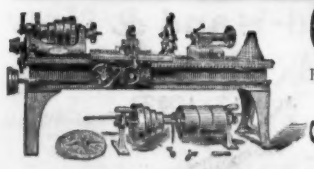

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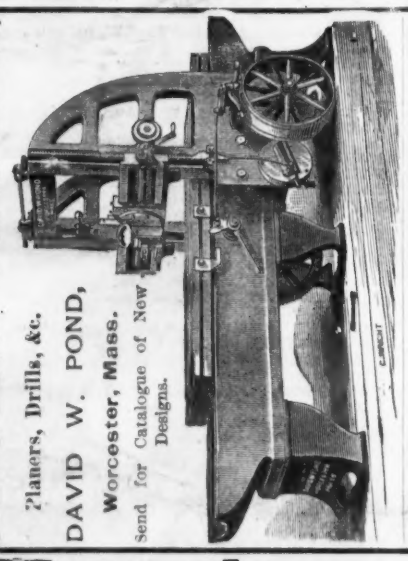
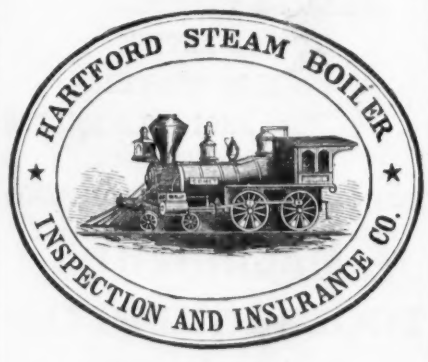
Send for Catalogue of New Designs.





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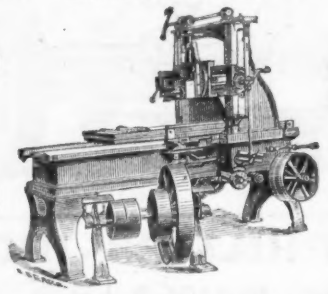
Sewing Machine Machinery.



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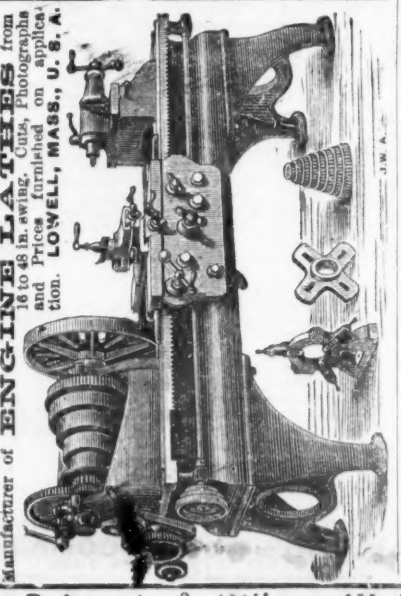

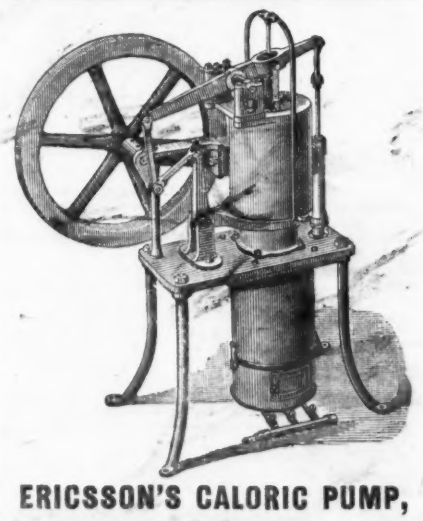

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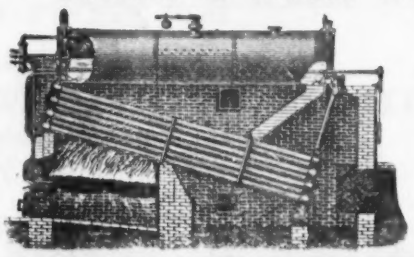

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